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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XXXIX., No. 26. FRIDAY, DECEMBER 29, 1905.

Mr. Frank J. Sprague's announcement last week that he was prepared to undertake the design and installation of 1500-volt, direct current heavy electric traction systems is interesting. He gives no details of his proposed system, but it must involve many new and necessarily untried services and methods. His proposal is as radical a departure from any previous practice in direct current installations as was the use of single or polyphase alternating current on the line. Almost from the beginning of electric traction 500 volts was considered the maximum safe limit of line potential, and even in the latest installations like the Interborough Subway and the New York Central Electric Zone 600 volts is the normal potential. Aside from one or two isolated and unsuccessful experiments, the generation and transmission of direct current at any higher potential than 800 volts has not yet been attempted in any field, so that Mr. Sprague's proposal to use a voltage more than two and a half times greater than the accepted maximum is indeed startling. If it can be done, as he claims, economically and safely, his invention will rank higher than his previous work which has given him the standing among electrical engineers which entitles this proposal to serious consideration. The greatest difficulty with high potential direct current generators and motors is the excessive sparking at the commutator segments if the number of segments is kept within narrow limits. To keep down the sparking, either the number of segments must be increased directly as the voltage, or two or more medium potential machines could be connected in series and thus produce a current of high voltage. Both of these methods have heretofore been considered objectionable, perhaps without reason, or Mr. Sprague may intend to depart altogether from previous practice and make a generator working on a new principle. The advantages of high potential transmission in the way of saving in copper and gain in efficiency hold true for direct current as well as for alternating current. We are quite ready to admit his claim that trebling the potential on the line under ordinary circumstances would permit increasing the distance between sub-stations about five times, with a consequent saving in sub-station apparatus. It is in the motor and control equipments on the cars that the greatest difficulty with high potential currents has been met. Connecting two or more motors permanently in series might prove disastrous in case one motor broke down and the entire load was thrown on its mate; and this is one of the commonest failures in electric traction. With the limited clearance under the cars there would be great difficulty in increasing the size of the commutator proportionately to the increase in voltage to prevent sparking; and the danger of grounded circuits through defective insulation would be enormously increased. Here again, the inventor may have departed from the old lines and adapted a new system of generation to a new system of transformation into mechanical energy. A more definite announcement of what Mr. Sprague proposes to do and how he is going to do it will be awaited with interest. Just now we are making only surmises based on what has been done.

The New York State Railroad Commission finds* that the signal was disregarded by the engineman of the Poughkeepsie train, in the case of the New York City collision of December 19, and thus disposes of the conjecture that the signalman may have turned the signal against the train after it was too late to make a stop; but aside from this the views and recommendations of the Commission will be regarded by most railroad men as hasty and ill-considered. The only sound and rational utterance in the report is that condemning the fixtures that support the emergency axes and other tools in the passenger cars, which, it appears, held the tools so firmly that there was delay in putting them to use. Whether it is the New Haven or the Central cars that are thus criticised does not appear. The Commission believes that a towerman should be allowed no discretion. The reasons for this are not given and can only be guessed. To forbid signalmen to move trains according to the needs of the local situation, as they arise, a hundred times a day, and which cannot without frequent delays be referred to some one else, who is out of sight, would be to forbid a practice which is common at all the busiest junctions and crossings throughout the country. To require a despatcher to control, by telegraph or telephone, the movements of trains at two or more junctions or crossovers not near each other is to introduce unneces-

*The New York State Railroad Commissioners reporting on the collision which occurred on the elevated structure of the New York Central & Hudson River Railroad, near 104th St., New York, Dec. 19, say:

"We find that the system of signals in use at this point is a modern one. We are of the opinion that the accident was caused by a combination of circumstances. We are confident that the signal was disregarded. The New Haven train was crossed over from Track 4 to Track 3 by Towerman Dwyer, on his own initiative.

"We are decidedly of the opinion that no such discretion should be exercised by men in the tower at this point, and that all train movements should be governed from a central point where all the conditions as regards the movements of trains on the road can be and are known by the central directing authority.

"It appears from the evidence that the emergency tools in the coaches are so securely fastened that it is a work of great difficulty to release them. A better system that will facilitate their release in emergencies should be adopted."

sary complications. The train despatcher on every railroad, depending always on the telegraph, may be said to do all of his work at a disadvantage. In great emergencies, and in many local situations where permanent busy conditions exist, he has to do just the opposite of what the New York Commissioners now propose. He has to delegate his authority to a man "on the ground"—that is, one close to the scene of the train-movements to be supervised. The statement of the towerman at 106th street that he diverted the New Haven train by order of the despatcher indicates, no doubt, that the despatcher keeps as close watch over the movements at 106th street as he can; and, very likely, that an attempt has been made to have all movements directed from the despatcher's office and that the attempt has failed. If a towerman exercises bad judgment there may be a question whether a more competent towerman is needed, but there is no question, in a case like this, that it would be a disadvantage to divide his authority with a man at a distance. But the Commissioners do not say that the towerman's judgment was wrong. In his case, as with that of the Poughkeepsie engineman, they appear to have reached a decision without first hearing all sides. The engineman, having been arrested on a criminal charge refused to testify before the Commissioners; and yet they have found and reported that he disregarded the signal!

Even the layman can see that to move traffic promptly at junctions or crossover tracks on a line where one train follows another every two minutes, or oftener, and where there are two main tracks for each direction, with trains running at varying speeds, the only way to make all movements with a minimum of delay is to lodge the largest discretion possible with the man in immediate control of the switches and signals. Either one of those two trains on the evening of December 19 might have been delayed a few minutes in the last two miles before reaching 106th street; the delay might have been such as to make necessary a different disposition of one or the other of them on reaching that tower; and the question what to do would have to be—ought to be—decided in perhaps half a minute, or less. To consult the despatcher might take two or three minutes; and every half minute counts. What could the despatcher have done in this case? He could have forbidden the New Haven train to cross to track No. 3 until the Poughkeepsie train had arrived and had been brought to a stand clear of the crossover. But such practice as that, besides causing frequent delays, discredits all the signals on the road. It says to the enginemen that a stop signal (with a suitable corresponding distant signal) is not depended on to stop them; which implies that when a train must be stopped something besides a stop signal and a distant signal will be used. At other places the stop signal *is* depended on. Could anything be more directly subversive of discipline?

RAILROAD BUILT IN 1905

Official returns from the majority of the railroad companies in the country, supplemented by figures furnished by the State Railroad Commissions and our own current records, show that approximately 4,388 miles of new main track have been built in the United States during the calendar year 1905. This figure includes 96 miles of new main track entirely relocated but does not include second track, sidings, nor electric lines. The sum total is 556 miles larger than last year's figure—3,832 miles—which was the smallest reported since 1898, when 3,265 miles were built. The actual increase over last year amounts to about 15 per cent., but this by no means represents the extent of railroad construction work during the year. The low figure in 1904 was largely due to industrial depression, and especially to the consequent suspension of work by some of the larger railroads on all new building which was not absolutely necessary, owing to the sharp decreases in earnings. Within the latter part of the current year, as a result of the large increases in earnings, work on many of these lines has been resumed but in a good many instances not completed. A large number also, of entirely new lines, work on which is well under way, have little or no track laid to contribute to the year's total. One factor which has delayed putting new mileage into operation has been the difficulty of getting rails, owing to the tremendous demand for iron and steel. More than one road on which grading has been completed has for this reason been compelled to postpone track laying until next spring. Several very large projects by existing lines have developed during the year, but have not progressed far enough to be included under the head of new mileage built. Within the next two years two or three of these should add a very large amount to the country's mileage. The Chicago, Milwaukee & St. Paul's Pacific extension will include from 1,500 to 2,500 miles of line; the Western Pacific, from Salt Lake City to San Francisco, nearly 1,000 miles; the Kansas City, Mexico & Orient has some 1,000 miles yet to build, and, in Canada, the Grand Trunk Pacific and Canadian Northern have together several thousand miles in prospect.

New main track mileage is reported in 47 states and territories, including Alaska, where 13 miles of new track were built. North Dakota leads the list with track laid on 520 miles, an increase of 488 miles over 1904. This was largely due to the completion of the new Minneapolis, St. Paul & Sault Ste. Marie connecting line from Thief River Falls, Minn., to Kenmare, N. Dak., through the heart of the Great Northern's branch line territory. The Great Northern itself built 120 miles of branch lines in the state during the year. Texas, which led the list last year with 323 miles, is second this year with 338 miles. Illinois is third with 250 miles, and Arkansas fourth with just under 200 miles. To have a state so full of railroads as Illinois come third in the list is an unusual result. The largest decrease reported is in Missouri, where only 49 miles were built, as compared with 270 miles in 1904. California, Minnesota, Mississippi and Pennsylvania, besides, each show 100 miles or more less than last year. The largest decrease in 1904 was in Oklahoma Territory, where 661 miles of new track were laid in 1903. Indian Territory also showed a similar decrease in 1904. The fact that the amount of new mileage built in these two territories in 1905 is in each case a decrease from the low figure in 1904 is pretty good proof that the most available situations in this a few years ago undeveloped territory are already seized upon. In addition to the four states already mentioned, which lead the list, Indiana, West Virginia, Oklahoma, Tennessee, Wisconsin, North Carolina, New Mexico, Mississippi, Georgia, South Dakota, Idaho, Minnesota and Alabama, in descending order of amount, built over 100 miles of main track in 1905. No new mileage was reported in Connecticut, New Hampshire, Delaware or Montana.

The number of miles built in Canada was 1,180, an increase of more than 300 per cent. over 1904, when 316 miles were built. This result is due primarily to the large amount of new track laid by one company in the western part of the Dominion, the Canadian Northern, which completed 600 miles of line. Much of this was, of course, nearly or entirely graded at the close of 1904, and the laying of the rails was all that remained to put it in operation. The Canadian Pacific in the same region also completed 277 miles of line. Mexico shows an increase of over 100 per cent., the mileage built being 238 against 115 in 1904. Several narrow gage mining and lumber roads which laid track during the year are not included in this total.

The following table shows our figures for mileage built in the United States during the last thirteen years:

1893.....	3,024	1898.....	3,265	1902.....	6,026
1894.....	1,760	1899.....	4,569	1903.....	5,652
1895.....	1,428	1900.....	4,894	1904.....	3,832
1896.....	1,692	1901.....	5,368	1905.....	4,388
1897.....	2,109				

A table of the new mileage built this year, classified by states, is given elsewhere in this issue.

STANDARD HEIGHT OF COUPLERS

There is a movement on foot to have the Master Car Builders' Association recommend to Congress a change in the Safety Appliance Law requiring couplers to be maintained with the center line between the maximum and minimum limits of 34½ in. and 33 in. from top of rail. At the October meeting of the Western Railway Club, Mr. J. J. Hennessey, of the Chicago, Milwaukee & St. Paul, introduced a topical discussion, advocating an increase in the allowable variation from 3 in. to 4 in., making the maximum height 35 in. and the minimum height 31 in. It is proposed to bring the subject up for discussion at future meetings of the other railroad clubs throughout the country, and bring such moral suasion to bear on the Master Car Builders' Association at its meeting next June as to force it to make the necessary recommendation.

Mr. Hennessey called attention to the serious delays in interchange resulting from the refusal to accept the many cars now in service, which are higher or lower than the prescribed limits, and the continual expense of trying to keep the height of couplers up

to the standard. One in every ten cars standing on the repair tracks needed attention in this respect. He went on to show in detail the settlement which takes place in a car. The figures are as follows: Wear on journal bearings, ⅜ in.; on journals, ¼ in.; on wheels, ¼ in.; on carry iron and bottom of coupler shank, ¼ in. each; on small wearing parts and settlement of arch-bars, ¼ in.; permanent set of springs, ⅜ in.; set of overhang of car from bolster to end sill, ⅜ in.; difference between empty and loaded height of car, 1½ in.; total, 3⅞ in. The vertical movement of couplers when running on the road he found not to exceed 2 in. On these figures as a basis he recommended an increase to 4 in. The majority of the members favored the recommendation, some even going so far as to say that 4 in. was not enough; 5 in. should be allowed.

This same agitation was begun in 1898, but it soon died out. In that year a committee of the Master Car Builders' Association was appointed to confer with the American Railway Association and the Interstate Commerce Commission with a view to having the allowable variation increased to 4 in. This committee reported in 1899 that it was inadvisable to recommend the change at that time for the reason that because of the link slot in the knuckles then in use, any increase in limits of height of couplers would result, in many cases, in only two knuckle lugs of adjoining couplers being in contact, causing frequent breakage of the knuckles and parting of trains. The committee recommended that action be deferred until the use of solid knuckles should become general. That was a convenient way of laying the matter to one side then, but now it has come up again.

The solid knuckle is now almost universally used, and many roads have increased the depth of the knuckle face from 9 in. to 10 in., and even to 11 in., as on engine and tender couplers. The change was made to gain strength in the knuckle, not to provide for additional vertical movement. Taking Mr. Hennessey's figures of 3⅞ in. settlement and 2 in. vertical movement when running, the total is 5⅞ in. With a 9-in. coupler face this leaves only 3⅛ in. of depth to resist the entire strain to which the coupler may be subjected. This extreme displacement of the center line of draft throws all the strain on the upper half of the knuckle pin and the top lug of the low coupler, and the lower part of the pin and the bottom lug of the high coupler, a condition much worse than when only the top and bottom lugs of two adjacent knuckles were in contact. In this case the lug on the coupler head is broken or the pin is bent and the coupler put out of operation, while formerly the knuckle broke. In a coupler the knuckle should be what a fuse is in an electric circuit, the part that goes first under excessive load. It can be replaced without taking down the draft gear and spare ones can be carried on the train for emergency uses. If a coupler breaks there is only the choice of setting out the car or chaining up.

Another argument brought forward by Mr. Hennessey is that inspection is more rigid now than formerly, and that loaded cars are refused when the coupler heights are only ¼ more or less than the requirements. He claims that the 4-in. limit of variation would permit greater freedom of interchange. If the railroads do not want to live up to the 3-in. requirement it is only a question of time when they would want to encroach on the 4-in. limit. So long as they are compelled to the railroads can and will keep their equipment up to standard in this respect. It may cost a good deal to lighten up old cars, raise the center plates and put them in proper condition, but it pays in the end. Displacement of the center line of draft is responsible for most of the broken and buckled sills, broken draft gear, couplers and knuckles, and oftentimes the complete destruction of a car in a minor collision. It is to be hoped that the Master Car Builders' Association as a whole will not commit itself to any action which encourages poor car building and lax maintenance.

THE RECEIVERSHIP RECORD OF 1905

The list of railroad receiverships during the year 1905 is on its face a remarkable one in that during the most prosperous year in the history of railroads in this country, ten roads have confessed their inability to meet charges—a larger number than in any of the previous four years. These ten bankrupt companies represent 3,796 miles of line and over $175,000,000 of total capital, which is more mileage and capital than has come under the jurisdiction of the courts in any of the preceding nine years. It is necessary to go back to 1896, the last year rich in receiverships of the disastrous 1893 period, when over 5,400 miles of railroad, with a total capitalization of over $275,000,000 failed, to find what seems to be a more disastrous year for American railroads. This result, so widely at variance with the actual fact, is, of course, due solely to the Cincinnati, Hamilton & Dayton and Pere Marquette receiverships; these the result, not of hard times, but of the most flagrant sort of railroad high finance, which had loaded the properties involved with some $70,000,000 of new debt. Leaving these two companies out of the account, the other eight railroads show a total mileage of 575 miles and total capitalization (stock and bonds) of $23,738,700, against roads with a mileage of 744 miles, representing a capitalization of about $36,000,000 failed in 1904. Therefore, disregarding the two exceptional receiverships of the year, the record is a thoroughly satisfactory one.

The list of railroad receiverships during the current calendar year is as follows:

Receiverships During 1905.

Name of road.	Mileage.	Bonds.	Stock.	Date receivership.
Ohio River & Western*	111	$600,000	$1,200,000	Jan. 25.
Phillips & Rangeley (2-ft. gage)	50	200,000	90,400	Feb. 1.
Warren & Corsicana Pacific...	27	60,000†	100,000	Feb. 14.
Pontiac, Oxford & Northern...	101	400,000	1,000,000	Mar. 25.
Port Angeles Pacific	6‡	120,000§	310,000	May 29.
Pittsb'g, Shawmut & Northern	209	7,053,600	11,700,000	Aug. 1.
Wiscasset, Waterville & Farmington (2-ft. gage)	27	850,000	150,000	Nov. 22.
Toluca, Marquette & Northern.	57	671,800	243,900	Oct. 7.
Cincinnati, Hamilton & Dayton / Pere Marquette	1,012 / 2,196	135,350,700*a*	14,925,500*b*	Dec. 4.
Total, ten roads	3,796	$145,306,100	$29,728,800	
Total bonds and stock....		$175,034,900		

*Receivership terminated March 31.
†Mortgage notes.
‡Built 1903; 80 miles additional projected.
§At rate of $20,000 a mile; $2,000,000 authorized.
a Including securities guaranteed.
b C., H. & D. stock; Pere Marquette stock (guaranteed) included in bonds.

Since the dark days of 1893, when 74 railroads with a total of nearly 30,000 miles of line came under the jurisdiction of the courts, followed by receiverships of over 100 roads, aggregating 16,500 miles of line in the succeeding three years, it has come about in less than a decade that great bankrupt systems have been brought to a condition of stable prosperity and the railroad receivership has been practically eliminated from the financial situation. It has remained largely to be taken advantage of by a few scattered, small and poorly situated railroads which have not found a place in any of the consolidations, and also as a convenient means of clearing up complicated legal situations. During the four years previous to 1905 only 26 railroads, with an average mileage of about 50 miles each, suffered receivership. Throughout the first seven months of the current year the record of failures shows little change from this satisfactory result, five railroads with an average mileage of less than 60 miles each, going into receivers' hands. It is the last five months—the most prosperous of the year—which have blackened the record. On August 1st a receiver was appointed for the Pittsburg, Shawmut & Northern, a soft coal road in northwestern Pennsylvania, operating over 200 miles of line. Up to this date it could be said that no railroad of more than 125 miles was under the jurisdiction of the courts. Early in December came the climax of the Cincinnati, Hamilton & Dayton fiasco, followed by a receivership for this normally prosperous property, and for its late acquisition, the Pere Marquette. Together, these two railroads include some 3,200 miles of line, a total in itself larger than the mileage of railroads which went into receivers' hands in any of the last nine years. This in itself shows how far the past year's receivership total comes from representing the present prosperity of the railroads of the country.

Of the other roads, the Ohio River & Western had as lately as 1903 undergone reorganization. Its 1905 receivership was soon terminated (on March 31) by the return of the road to its owners. The Pontiac, Oxford & Northern had similarly passed through an earlier receivership. The Port Angeles Pacific, when receivers were appointed, had completed only six miles of a projected line from Port Angeles, Washington, south to a connection with the Northern Pacific near Grays Harbor. The receivership of the Pittsburg, Shawmut & Northern came as a necessary step in a reorganization which is to give the road more working capital and enable the construction of north and south outlets toward Buffalo and Pittsburg. The Toluca, Marquette & Northern belonged to the Charles J. Devlin chain of financial enterprises in Kansas. With the failure of Mr. Devlin's banks, the road was on November 22 put in the hands of the three present receivers, one of whom is James E. Hurley, General Manager of the Atchison, Topeka & Santa Fe. This makes it likely that that company, whose main line in Illinois it crosses, will soon come into possession of the road. The year has been a disastrous one for only one

class of roads, those with the unusually narrow gage of two feet. The Phillips & Rangeley and the Wiscasset, Waterville & Farmington represent over one-half the total 2-ft. mileage in the United States. The Warren & Corsicana Pacific was originally a 3-ft. gage lumber road, which has since been made standard gage. Under present methods of railroad operation it is not hard to understand the handicap under which narrow gage railroads operate and the consequent likelihood of failure to meet charges on their part.

With the exception of the Ohio River & Western, which, as already mentioned, stayed only a little more than two months in receivers' hands, all of the last year's receiverships remain in force at its close. We are informed that the receivership of the Warren & Corsicana Pacific will probably be continued for the next two or three years. This will probably be true of several of the other small roads. If it is possible to judge by the activity of the Pittsburg, Shawmut & Northern management in beginning work on a southward extension or the extensive coal resources of the road, its receivership should before very long be terminated. The Cincinnati, Hamilton & Dayton and Pere Marquette tangle will take some time to straighten out. Already it is announced that the attempt will be made to break the purchase of the Chicago, Cincinnati & Louisville, which, by the way, is not directly involved in receivership, by the Pere Marquette, and the lease of the Pere Marquette to the C., H. & D.

When the reorganization is complete, it is not unlikely that the parts of the quondam Great Central Route will be acquired by those of the trunk lines which can use them most effectively. On account of its many points of competition with the Michigan Central, it has seemed probable that the Pere Marquette will come under Vanderbilt control. It is not likely to be bought directly by the Michigan Central because of laws prohibiting common ownership of competing lines, but the Lake Shore might easily be employed as a holding company. The Cincinnati, Hamilton & Dayton, by itself a valuable property, if for no other reason, as a large originator of traffic and part owner of the Cincinnati, New Orleans & Texas Pacific, can hardly long remain independent. The Pennsylvania or the Erie seem the most likely purchasers. It is not unlikely that the Erie would consider the road, released from burdensome contracts and controlling, as it does, the Erie's entrance into Cincinnati, a desirable purchase. The Chicago, Cincinnati & Louisville, a weak road between Cincinnati and Chicago, which has not yet acquired its Chicago entrance, must also in all probability find its way into the protecting control of some one of the strong trunk lines.

The C., H. & D. and Pere Marquette receiverships point their moral strongly enough as a warning against financial manipulation of a railroad's credit instead of development as an operating property. It may be hoped the lesson will not have been preached in vain. Aside from these exceptions, the small extent of the year's failures is only another evidence of the country's present tremendous prosperity.

Profits from Electrification of Street Railways.

The great profits coined during the last decade, especially in eastern cities, by the shifting to electric equipment of the old horse railways is a familiar fact which has not yet reached its ultimate. Not so familiar, and, indeed, very rare, have been actual examples measuring accurately those profits under the common device of recapitalization. A case called to our attention is that of the Fair Haven & Westville Horse Railway Company, the corporation which first laid street railway tracks in the city of New Haven, Conn., about half a century ago. It was prosperous and paid 8 per cent. dividends for many years before it adopted the trolley. Later it absorbed the whole of the New Haven street railway system and of the region roundabout. The table annexed, with fractions of shares (par $25 each) omitted to simplify the figures, shows the evolved recapitalizations and profits of the stockholders:

January, 1894.	Bought at $55......	100	shares............	cost,	$5,500
June, 1894.	Increase, 1 for 2....	50	"	"	1,250
March, 1897.	Increase, 1 for 2....	75	"	"	1,875
Nov., 1898.	Stock dividend	225	"	"	.....
October, 1899.	Increase 1 for 4....	112	"	"	2,800
October, 1901.	" 1 " 5....	132	"	"	3,300
October, 1902.	" 1 " 6....	115	"	"	2,875
June, 1903.	" 1 " 4....	202	"	"	5,050
		1,011			$22.650
Average cost per share					$22.40

The table, enlarged in ratio to an original purchase of 100 shares, is based on an actual transaction. In the spring of 1904 the New York, New Haven & Hartford (Steam) Railroad Company bought up the Fair Haven & Westville and later practically extinguished its stock. The purchasing corporation paid 2 for 1 in its own 3½ per cent. debentures worth in the market 96, bringing the market value of the shares of the street railway to 48. The final summary, therefore, shows that the original investment of 100 shares in 1894 became 1,011 shares during ten years and was worth $48,528 as against a total cost of $22,650, or a profit of $25,878, or about 114 per cent.—this after receiving 8 per cent. dividends for a year and 5 per cent. on the increased capital for six years since. The progressive increase ten-fold of the capital stock will be noted as also the stock dividend of 100 per cent., which by no means is an accurate hydrometer as a number of the absorbed companies of the Fair Haven & Westville were very dropsical. As a final fact it may be added that the New York, New Haven & Hartford Company has made such a good thing out of its purchase that the old street railway shareholders now regret that they sold out at all. This case of electrification profits, based on the popularity and operating economy of the trolley, has, doubtless, many a parallel in the older American cities. Besides its value as an objective study it exemplifies the obstructions and inequities which befog capitalization of street railways as a basis for municipal purchase and control.

The officers of the Peninsula division of the Chicago & North-Western have given a fine exhibition of their resourcefulness and of the excellence of their organization by running a hundred miles of busy line for two days without the telegraph; but in attempting to tell just *what* they have done, we are baffled, because no details are given. Operating officers would often do well to take a leaf from the experience of the engineering and legal departments, to the extent of imitating the methods of those departments in preparing precise and full records of exceptional accomplishments, even at the expense of some time and money. Such records often prove valuable, and they are always interesting for publication. We have in mind a time-saving scheme for the management of passenger trains at meeting points on single track which was put in use on 20 miles of a prominent road near New York City a few years ago, but which could not be satisfactorily described because the amount or degree of saving was not carefully recorded. The time saved at each meeting was small, but yet it was large enough (with the added safety) to warrant the expense of the change in tracks and signals, and to merit the attention of superintendents of other roads; but no data had been recorded to show how many train movements had been bettered, how many dollars saved or how many complaints forestalled. By establishing long sidings, and having a full equipment of interlocked switches and signals, passenger trains could meet each other in most cases without stopping, and always without flagging. The saving in time proved to be a marked benefit. But that was all that we could learn. This C. & N.-W. incident is like that one. The Peninsula division includes 464 miles of road. In October a sleet storm paralyzed the telegraph for 48 hours. In this emergency every iron mine would have had to shut down on account of the shortage of cars unless the road was kept running. The train dispatcher was temporarily out of the game. But they managed, "on a single track line, without telegraph lines, for two days and nights, to keep every iron and copper mine in the district supplied with cars and moved all trains practically on time." This is the substance of the report, as given to a newspaper, leaving out the erroneous parts; and the really instructive figures were not touched upon. The reporter did not learn enough to make a really descriptive account; and he not only failed to show what the officers and trainmen actually had done, but in his effort to make a good "story" grossly exaggerated the few statistics that were given. The "4,071 cars moved" (not 4,971) represented the business of two days on the division; but we learn that the paralysis of the telegraph affected only 100 miles. The management of the trains without the aid of the telegraph was highly creditable to all concerned, especially as two temporary dispatching offices had to be established; but the emergency work did not cover 464 miles, or even 100 miles, for a part of the 100 is double track. We can ask the reader to join us in congratulating the North-Western people on having done some fine work, but we cannot tell him what the work was!

From Chicago, the birthplace of sensations, it is announced that the railroads are going to "tell on each other," or, in more dignified phrase, are going to unite in assisting the Interstate Commerce Commission in exposing those intricate and varied methods of rate cutting, the secret practice of which has hitherto been the cause of so many railroad woes. The traffic officers have gone so far as to make an appointment with the Interstate Commerce Commission at Washington this week, and it is said that there will be a frank though informal conference on ways and means. It is said that fourteen traffic officers will take part in this conference. As this number includes many conservative men, it is by no means unlikely that some useful result may follow. The hope, aroused by the Elkins bill of 1903, that the abolition of imprisonment would clear the atmosphere by making it much easier to get evidence of rate cutting, has been long deferred; but it is never too late to mend. To expose your competitor's unlawful act does, indeed,

seem unneighborly; but how much worse is it than to try to punish him by becoming a law-breaker yourself? Another motive for now using every possible means to expose unlawful rate making is found in the recent action of the Federal district attorneys in prosecuting freight agents and shippers under the conspiracy law, as was done in the case of the Chicago packers who paid $25,000 in fines. Under that law imprisonment still remains one of the penalties, and it applies to a freight agent who conspires with another person to break a federal law, notwithstanding the efforts of Mr. Elkins to keep railroad men out of jail. The names of the committee which is visiting Washington are said to be: J. C. Stubbs, Union and Southern Pacific, chairman; Darius Miller, Chicago, Burlington & Quincy; H. R. McCullough, Chicago & North-Western; W. B. Biddle, Chicago, Rock Island & Pacific; J. H. Hiland, Chicago, Milwaukee & St. Paul; J. T. Harahan, Illinois Central; C. S. Clarke, Missouri Pacific; A. S. Dodge, Chicago & Eastern Illinois; S. C. Stickney, Chicago Great Western; Burton Johnson, Wisconsin Central; Benjamin Campbell, Great Northern; J. M. Hannaford, Northern Pacific; H. L. Sielcken, Kansas City Southern, and A. A. Allen, Missouri, Kansas & Texas. Some reports give a list somewhat different, but all lists are made up of high officers, indicating a serious determination.

Great Northern.

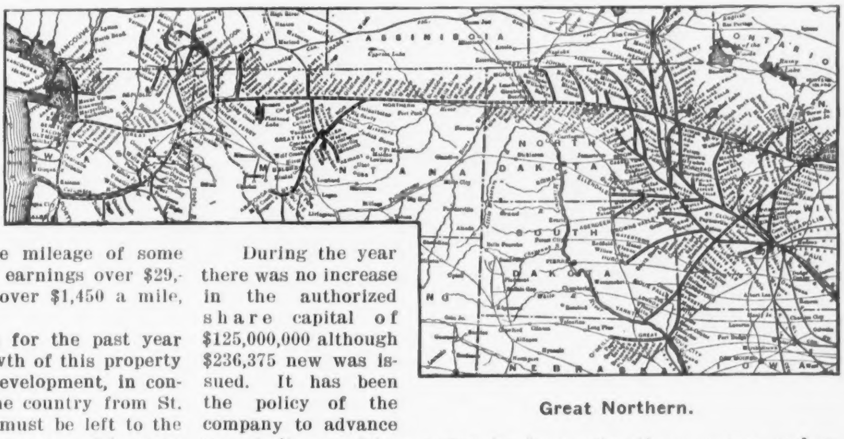
In 1902 Mr. Hill said, or was reported to say, that the gross earnings of the three properties making up the Northern Securities Company would, in the ensuing year (1903), reach $150,000,000. The magnitude of the figure surprised many people, for not only great in itself, it required great increases for its fulfillment. It is interesting to note, therefore, how the earnings of these three properties have worked out in the last three years. In 1902 they earned $131,214,882 with 18,377 miles of line. In 1903 these properties fell slightly short of Mr. Hill's estimate, but they nevertheless earned $149,566,131, with a mileage of 18,921. In 1904 they exceeded the 150-million mark, earning $151,810,119 with 19,312 miles of line, and during the current fiscal year they increased this to $160,222,020. It is worth while to consider these figures not alone in their merely statistical sense, but to realize what it means in the growth of the country when these three railroad companies, which are now operating an aggregate mileage of some 20,000, have in four years increased their gross earnings over $29,000,000. The increase alone has amounted to over $1,450 a mile, in spite of the increase in mileage.

The gross earnings of the Great Northern for the past year amounted to $43,526,088. The characteristic growth of this property in recent years has been through branch line development, in connection with the main stem stretching across the country from St. Paul and Duluth to Seattle and Vancouver. It must be left to the branch lines to bring in a constantly increasing source of tonnage from the rich agricultural lands through which the road runs, and also from the iron country, smaller in extent but very profitable. It is to be regretted that the annual reports of the company do not give in greater detail a statement of the kinds of freight which contribute to the constantly swelling ton-mile totals, for it would be interesting to know what proportion of the whole amount is Oriental freight, as against the two great staples of grain and iron ore for home consumption. Freight traffic contributed $33,512,744 of the total earnings this year, and ton-miles of revenue freight *increased* 818,358,569 units during the year. It must be recollected, however, that the year 1904, like 1901, was an off year for the company, in the sense that earnings, both gross and net, were smaller than in the year immediately preceding. Comparisons, therefore, show up uncommonly favorable for 1905, yet, skipping 1904 and going back to 1903, the year which previously beat all traffic records by tremendous figures, it is seen that gross earnings this year beat the record by some $3,000,000.

The Great Northern this year prints a table, which is not specially instructive, but is rather amusing, showing what revenue would have been collected on the 1905 traffic if it had been charged on the basis of the average ton-mile rate in 1881, from which it is deduced that the voluntary reduction of rates during the 25 years has saved this year's shippers over $87,000,000. Of course, the obvious fallacy here is that the 1905 traffic would not and could not have moved at the 1881 basis whether the company so wished it or not; also that great increases in heavy traffic hauled long distances pulls the average rate down mechanically. But in spite of these defects, the table is interesting as showing the broad tendency in American railroad development. The average ton-mile rate in 1881 was 2.8 cents; during all the years between that year and 1905 there has only been a single one (1904) when the average rate was higher than it was in the year immediately preceding, and in 1905 the average rate had fallen to .792 cent.

Operating expenses increased during the year from $20,594,363 to $21,441,927, leaving net earnings $22,084,161 in 1905, as against $19,462,991 in 1904. In spite of the large increases in traffic the item of conducting transportation showed a considerable decrease during the year. This decrease was occasioned at the same time that a considerable increase was shown in the cost of station service. Although full cost statistics are not given, the saving may doubtless be attributable in part to less cost of coal and in part to the great care which the company took, in common with other large roads of the country, to cut down its expenses to the smallest possible limit, after the rather extravagant years 1903 and 1904. As a specific way in which an economy has been effected this year, it is worthy of note that the train load, always surprising in consideration of the country traversed and the character of the freight, was increased this year to an average of 522½ tons (revenue), an increase of 75 tons over the 1904 loading. The number of cars per freight train mile was increased to 37⅓. The tons of revenue freight per loaded car was increased from 18 to 20, and freight train-mile earnings were increased from $4.06 to $4.20, although the ton-mile rate was reduced from .893 cent to .792 cent. It is also noteworthy, in the face of the larger traffic, that the helping mileage of freight locomotives decreased 16,357 miles, and of passenger locomotives, 30,933 miles, a decrease greater than the total passenger helping mileage in 1905.

The increases in the operating account were chargeable primarily to maintenance. The company does not publish figures which enable a statement to be made of the maintenance charge per locomotive and per freight car and passenger car, as would be desirable. The entire charge for maintenance of equipment, however, increased from $3,138,693 to $3,749,131, while the number of locomotives in service decreased from 708 to 707, although the number of freight cars increased from 32,375 to 32,870. The charge for maintenance of way and structures was $5,571,189, as against $5,083,264 last year. The current figure is at the rate of $973 per route mile.



Great Northern.

During the year there was no increase in the authorized share capital of $125,000,000 although $236,375 new was issued. It has been the policy of the company to advance sums to its proprietary companies for construction purposes, and receive their stock in payment, and $17,000,000 of such stock was acquired during the year. The expenditure made on the capital account by proprietary companies for work completed or under construction aggregated $788,806, chiefly chargeable to the Seattle & Montana and to the Eastern Railway of Minnesota. The funded debt in the hands of the public increased approximately $4,000,000 during the year, which brings the total capitalization of the system for which the Great Northern Railway Company is responsible, directly or under guarantee, up to $225,479,064, bonds and stock. This is at the rate of approximately $36,316 bonds and stock per mile of main track, a very sound and conservative showing.

The following table summarizes principal statistics of the year's operation:

	1905.	1904.
Mileage, June 30	6,110	5,951
Freight earnings	$33,013,722	$29,944,300
Passenger earnings	8,000,467	7,747,300
Mail earnings	1,035,937	1,017,204
Gross earnings	43,526,088	40,057,353
Conducting transportation	10,463,218	10,740,242
Maint. way and structures	5,571,189	5,083,264
Maint. of equipment	3,749,131	3,138,693
Operating expenses	21,441,927	20,594,363
Net earnings	22,084,161	19,462,991

NEW PUBLICATIONS.

Steam Engineering. By W. W. F. Pullen, M. Inst. M. E., etc. The Scientific Publishing Co., Manchester, England.

Following out the statement made on the title page, the book is a treatise on boilers, steam, gas and oil engines, and is intended for the use of elementary students in technical schools and science classes. For a book of 454 pages, it contains a large amount of guiding data. It cannot be expected to treat exhaustively all of the subjects that it touches upon, which includes a synopsis of mechanical laws and definitions, steam engines, both reciprocating and turbine, and the measurement of their power; boilers and their auxil-

iary machinery with a measurement of heat; the indicator and the slide valve, with a final chapter on the internal combustion engine. The conciseness and clearness are features that appeal to the reader. Item after item is taken up and treated in a paragraph or in several pages, as its importance may warrant, but invariably in a manner that tells its story and leaves nothing of what has been said doubtful or in the dark.

As the treatise is prepared for the use of students, a brief outline is given of numbers of experiments intended to establish the truth of the statements that have been made. While ostensibly for elementary students they contain many suggestions that are of value to engineers who have original investigations on hand. In the study of the indicator card several defective ones are given, with the reasons for their defects; a method that could well be followed by most writers on the subject, who are rather disposed to ignore faults due solely to the improper adjustment of the instrument. These are little things, but they count mightily in the value of a book to the practical worker, to whom, by the way, it must be borne in mind, this does not claim to cater; nevertheless it cannot fail to be a very handy book of reference on the shelves of any engineer who is engaged along these lines.

Lippincott's New Gazetteer of the World. Edited by Angelo Heilprin, of the Sheffield Scientific School of Yale University, late President of the Geographical Society of Philadelphia, etc., and by Louis Heilprin, author of the Historical Reference Book, etc. Philadelphia and London: J. B. Lippincott Company, 1905. A complete pronouncing gazetteer of the world. 2,052 pages, 6½x10½ in. Price, $10.

In the advance of civilization along imperialistic lines, the reader now has to know so much about India and South Africa, Australia, Japan, China, the Philippines and Cuba that the old geographical handy reference books have lost much of their value. A faithful and successful attempt has been made in the new Lippincott Gazetteer to array all the towns of the world where the reader can learn at least something about them (including the way their names are spelled and pronounced) at a moment's notice. In the publisher's note attention is called to the fact that Lippincott's Pronouncing Gazetteer, in its different editions, has been before the public for just half a century, the first edition having made its appearance in 1855. The present publication, which is printed new from cover to cover, is a new work embodying little more than the frame-work of its predecessor. The editors explain that the standards of inclusion have to be varied in different parts of the world according to what might be called the market for information. The critical student of obscure geography will find some omissions, but he will be much more impressed by what he finds than by what he does not find. A gazetteer is a pretty indispensable part of the equipment of any first-class library or editorial office at the present time, and it is just and fair to say that Lippincott's is the best gazetteer there is.

American Railroad Rates. By Judge Walter C. Noyes. 276 pages, 5½x8 in. Published by Little, Brown & Company, Boston, 1905. Cloth. $1.50.

After a year of the widest publicity about all details of railroad operation, which have been expounded and discussed in a campaign of education directed respectively for and against rate regulation by the Government, a theoretic discussion of the subject labors under a considerable disadvantage. Judge Noyes has written a thoroughly careful résumé of the entire subject of American railroad rates and rate making. His points are brought out clearly, and he uses throughout a system of tabulating, by means of numbered paragraphs, of the arguments on the main points at issue in such a manner that the situation is made very plain to the reader. The disadvantage already referred to—that the reading public is tired of the subject—will probably prevent the book from being fully appreciated at present, but it constitutes a document which should have considerable historical value as showing accurately and fairly the existing situation at the period when the clamor for Federal interference received its most definite impetus.

Electrical Pocket Book and Diary for 1906.—The Technical Publishing Co., Ltd., Manchester, 1905. Leather, gilt edges, 3¼ in. x 5½ in., 440 pages. Price, 1s. 6d.

This is one of the series of "The Practical Engineer" pocket-books, and contains information of much the same character as that included in other similar handy reference books. Most of the data relates to English practice and the complete Board of Trade requirements are included. A small diary printed on ruled section paper is bound in the back of the book and is a useful and convenient adjunct.

Pocket Book of Mechanical Engineering.—By Charles S. Sames. Published by the author: Jersey City, N. J. 1905. Flexible leather; 168 pages. Price, $1.50.

This is a new addition to the list of engineering pocket books, and while it is not so large as most of the others in point of size it contains in very condensed and well arranged form a goodly amount of data, formulæ, examples and theory. The general divisions of the book are: Mathematics, Chemical Data, Properties of Material, Strength of Materials and Machine Design, Energy and Transmission of Power, Heat and Steam Engines, Hydraulics, Shop Data and Electrotechnics. An excellent index adds much to the convenience and value of the book.

The Practical Engineer Pocket Book—1906 Edition. The Technical Publishing Co., Ltd., Manchester, 1905. Leather, gilt edges, 3½ in. x 5½ in., 600 pages. Price, 1s. 6d.

The 1906 edition of this standard English engineering pocket book has been completely revised and some new matter added, including notes on Recent Tests of Mechanical Stokers, Forced Draft, Indicators, Emery Wheels, Gas Producers, etc. It has been kept within reasonable limits of size and is a handy and valuable little volume in every respect, although naturally more suitable for English than American engineers.

TRADE CATALOGUES.

The Walschaert Valve Gear.—A fully illustrated and well gotten up catalogue descriptive of the Walschaert valve gear is being distributed by the American Locomotive Company. A general description of this gear, prepared by Carl J. Mellin, is given, as well as a number of illustrations showing the gear in detail and as applied to various types of locomotives. A table of the comparative weights of the Stephenson and Walschaert valve gears is given, in which it is shown that from 1,200 to 1,700 lbs. can be saved by the use of the Walschaert gear. The opinions of the Walschaert gear as expressed by a number of eminent railroad men and other authorities are also given, as well as a statement by H. F. Ball, Superintendent of Motive Power of the L. S. & M. S., in regard to the results obtained with it in actual service.

Fuel Economy.—The Falls Hollow Stay Bolt Co., Cuyahoga Falls, Ohio, has had reprinted in pamphlet form two recent papers by Mr. John Livingstone read before the St. Louis Railroad Club and the New York Railroad Club. The paper read before the St. Louis Railroad Club is entitled "Coal. Its Uneconomic Use and Abuse Generally, by Steam Makers but Especially by the Railways, and How to Save Full Fifty Per Cent." It advocates the use of hollow staybolts to admit air into the firebox in sufficient quantities to cause complete combustion of the coal fired. The New York Railroad Club paper is entitled "The Quality and Utility of Solid, Flexible and Hollow Staybolts," and is a comparison of these three types of staybolts.

Transformers.—Bulletin No. 1,047 of the electrical department of the Allis-Chalmers Co., Cincinnati, Ohio, illustrates and describes the Bullock oil-insulated transformers for high-tension alternating currents. These transformers are made in all sizes and in two types, self-cooled and water-cooled. The self-cooled type is made up to 300 k.w. capacity and the water-cooled type from 100 k.w. capacity up. They are made to step-up or step-down the voltage to or from as high as 50,000 volts, and are built for either 25-cycle or 60-cycle circuits.

Single Phase Railway Apparatus.—In circular No. 1,127 of the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., the Westinghouse electric and electro-pneumatic, multiple-unit control systems for single-phase alternating current car equipments are illustrated and described together with sliding contact and bow trolleys for use on high-speed lines.

Locomotive Blow-Off Valves.—The Lunkenheimer Company, Cincinnati, Ohio, sends a two-leaf pamphlet printed in colors describing the Lunkenheimer locomotive blow-off valve, a new valve recently placed on the market. In addition to illustrating and describing the device in detail, the method of attachment to the boiler is illustrated.

Friction Clutches.—The Reliance friction clutch is illustrated and described in Bulletin No. 1,202 of the Allis-Chalmers Co., Milwaukee, Wis. They are made in sizes to transmit from 30 to 425 h.p. at 100 r.p.m.

Multipolar Motors and Generators.—Bullock multipolar motors and generators are illustrated and described in Bulletin No. 1,046 of the Allis-Chalmers Co., electrical department, Cincinnati, Ohio.

Crane Motors.—The Northern Electrical Mfg. Co.'s enclosed type of crane motor is described in Bulletin No. 32.

"The Scott Special."—The Santa Fe has prepared an interesting account of the record-breaking run of the "Scott Special" from Los Angeles, Cal., to Chicago, in July. (*Railroad Gazette*, Sept. 8.) The narrative was written by a member of the party and describes all

of the interesting details of the trip. The account is illustrated by portraits of the principals, of the enginemen, views of the train and typical locomotives, and gives a map of the line and a profile. There is also an appropriate cover design.

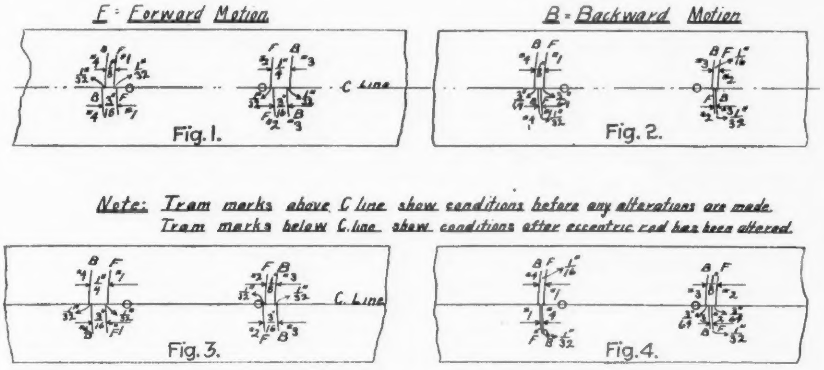
CONTRIBUTIONS

Setting Valves With the Walschaert Gear.

Philadelphia, Dec. 22, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of December 8 was an article on this subject by Mr. T. F. Crawford describing the method in use at the Baldwin Locomotive Works. A number of misstatements in that article should be corrected for the benefit of those who may be called upon to set valves with the Walschaert gear.



Figs. 1 to 4—Tram Marks on Valve Stem.

Mr. Crawford says that the eccentric rod should be shortened when the backward motion laps the forward motion. This is correct only for the particular case to which he refers which is reproduced in Fig. 1, herewith. It is desired to alter the eccentric rod in such a way that the ¼ in. will be reduced and the ⅛ in. increased until they are equal. Four points must be moved; therefore we take one-fourth of the difference between ¼ in. and ⅛ in. or $^1/_{32}$ in. to obtain the amount of the movement of the valve rod for each point. So if point No. 1 is moved to the right $^1/_{32}$ in., point No. 2 to the right $^1/_{32}$ in., point No. 3 to the left $^1/_{32}$ in. and point No. 4 to the left $^1/_{32}$ in., we have $^3/_{16}$ in. between points 1 and 4 and $^3/_{16}$ in. between points 2 and 3. The forward gear has a direct motion and the backward gear has an indirect motion. If now, the eccentric rod be altered enough to move the valve stem so that point No. 1 will come $^1/_{32}$ in. to the right and point No. 4 $^1/_{32}$ in. to the left, the rod must be shortened. Taking up points 2 and 3, it will be seen that shortening the eccentric rod moves point No. 2 to the right and point No. 3 to the left the desired amounts. In this case the statement made is correct.

But let us transfer the quantities ¼ in. and ⅛ in., leaving the other conditions the same. (See Fig. 3.) We still have to move the points $^1/_{32}$ in., but this time in the opposite direction to make them equalize. Point No. 1 moves $^1/_{32}$ in. to the left and point No. 4 moves $^1/_{32}$ in. to the right, while point No. 2 moves $^1/_{32}$ in. to the left and point No. 3 moves $^1/_{32}$ in. to the right. Hence if the eccentric rod be lengthened instead of shortened, points 4 and 1 will approach and points 2 and 3 will separate as is desired. Therefore it will be seen that the statement that the rod should be shortened is not true for all cases. In the above cases we have $^3/_{16}$ in. more lead on the backward motion than on the forward motion. It now remains to move the eccentric so that the $^3/_{16}$ in. will be divided. Unless this is done the movement would be $^3/_{64}$ in. on the valve stem.

In Fig. 2 we have ⅛ in. between points 4 and 1 and $^1/_{16}$ in. between points 2 and 3. Since both points of the forward motion fall on the same side of the corresponding points for the backward motion we add the quantities and take one-fourth of the sum, which gives $^3/_{64}$ in. as the amount of movement on the valve stem. From the figure it is evident that by lengthening the eccentric rod the desired movement will be obtained and that the backward motion laps the forward $^1/_{32}$ in. on both ends, which leaves $^1/_{64}$ in. to be taken up by moving the eccentric.

Referring to Fig. 4 we have the quantities transposed, which requires the eccentric rod to be shortened, but this time we have the forward motion lapping the backward motion by $^1/_{32}$ in., which necessitates an eccentric movement of $^1/_{64}$ in. in the opposite direction to that in the case previously considered. The object of this manipulation is to adjust for equal lead for both points in forward motion and equal lead for both points in backward motion and then to equalize the leads for both motions by the eccentric.

The second error in the article is the statement of the reason for using three-quarters of the amount of movement shown on the valve stem in altering the length of the eccentric arm. It has been shown why one-quarter of the sum or difference is taken for equalizing the lead in forward and backward motions. The reason for taking three times this amount in the particular case under consideration in altering the eccentric rod is derived by an entirely different method from that assumed by Mr. Crawford.

In Fig. 5 is shown the arrangement of the gear and its parts. The link is suspended at the center of the slotted portion and from this center C to the point of attachment of the eccentric rod is the arm B. The distance from C to the center of the link block when in full gear backward or forward motion is the arm A. The ratio of these lever arms determines the amount of the valve stem movement to be taken in altering the eccentric rod.

Let a = amount of movement on the valve stem.

x = amount of alteration required on eccentric rod.

Then A:B::a:x or A x = B a from which $x = \left(\frac{B}{A}\right) a$. The ratio of $\frac{B}{A}$ for the gear in question—the Pennsylvania Railroad consolidation engines—is approximately 3 to 1; hence the eccentric rod is altered three times the amount shown on the valve stem. In this case, the amount was ¼, hence the rod is altered three times ¼ or ¾. It is evident that this ratio will be different for every different design of gear and must be furnished to the men who set the valves by some one familiar with the design of the gear.

In the case of the Pennsylvania Walschaert gear the crank arm or eccentric was keyed fast to the main pin before being brought to the erecting shop, the position being located by means of a template. Therefore, if the eccentric was located too far ahead or too far back the result would be to increase the lead in one motion and reduce it in the other motion. This eccentric arm was so accurately located in this way that out of an order of 160 locomotives the lead did not vary more than $^3/_{64}$ in. from the amount designed to be given, which was ¼ in., and this extreme error was found only in a very few cases, most of them being perfect.

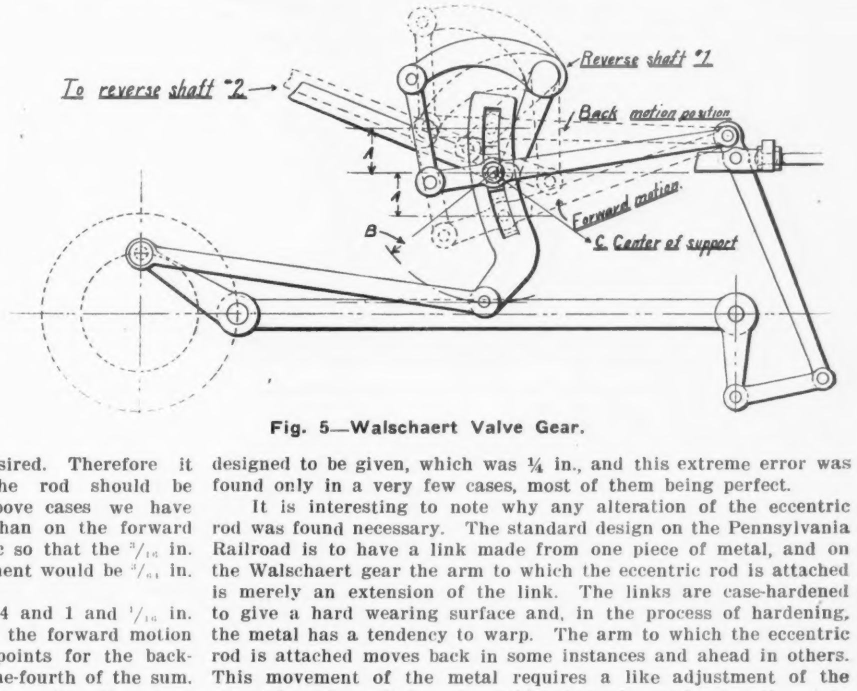


Fig. 5—Walschaert Valve Gear.

It is interesting to note why any alteration of the eccentric rod was found necessary. The standard design on the Pennsylvania Railroad is to have a link made from one piece of metal, and on the Walschaert gear the arm to which the eccentric rod is attached is merely an extension of the link. The links are case-hardened to give a hard wearing surface and, in the process of hardening, the metal has a tendency to warp. The arm to which the eccentric rod is attached moves back in some instances and ahead in others. This movement of the metal requires a like adjustment of the eccentric rod, as it is not considered good practice to attempt to bend this arm back to place after it has been hardened. This is an error which cannot be allowed for in the manufacture of the link.

as no two pieces of metal perform alike in the process of case-hardening owing to different degrees of expansion and contraction.

ROY C. HARDING,
Track Foreman on Valves, Baldwin Locomotive Works.

An Engineman's Reply to Criticism.

South Portland, Me., Dec. 20, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The extracts from the paper of the claim department of the A. B. & C. Railroad in the *Railroad Gazette* of Dec. 15 are of no small interest to the fraternity. To the layman its don'ts, and its recommendations, will appeal strongly as being very easy to carry out. But the layman generally sees but one side of the case, and draws his conclusions accordingly. To men who know both sides, who know all the whys and wherefores, the matter looks different. At the outset, however, I will agree with the author of the paper that a majority of the accidents are caused by bull-headedness. Others are purely unavoidable, and no amount of vigilance can forestall them. The author asks, in connection with one accident, should not trains be blocked one station apart? I fully agree with him that this is the only *absolute* prevention of rear collisions, this rule to apply under all circumstances. But the average official will hold up his hands in horror and say, impossible! We could never get trains over the road were we to adhere to such a rule as that. That does not in the slightest degree alter the fact of its absolute safety, and at the end of the year the company will make a better financial showing, beside establishing a record for safety. To be sure, there are very many violations of rules winked at by officials as long as nothing happens. Some day something happens and the official eye is opened to the thing winked at. It is then too late.

The author says don't run curves, etc. As long as enginemen are hounded for every minute lost they are going to try and make time regardless of curves, and will take many chances rather than be asked to explain, by telegraph, the reason of each minute's loss of time. The time is expected to be made, rain or shine, snow or blow, regardless of zero weather. Not long since a brother engineman on a fast night run lost a minute between stations. On reaching the next station up comes the conductor with a message, why did you lose a minute between A and B? This reply was perhaps not very satisfactory: "Tell them I did not run fast enough." Perhaps there were some curves he did not dare run so fast around. Yet, why did you lose a minute? Just as if that minute was the last. It is very fine to talk about making a station stop, then another for a waterplug, and be nagged because you do not make the time.

It is indeed aggravating to have all the dishes slide along the table of the diner at every stop, but is the engineman always to blame? In many cases the engineman cannot handle the air as nicely as "the other fellow"; that is where the "air car" fails. You can make pretty stops in the car with the "dummies," but all the explanations in the world cannot help you do the same on the road in practice.

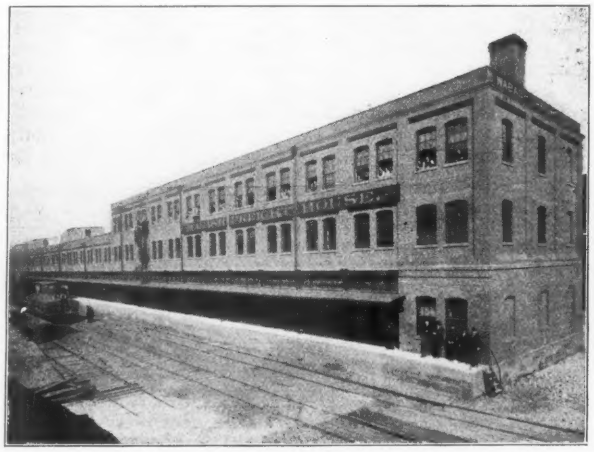
As to brake-shoes, grease plugs, etc., mentioned by the author, the closest possible inspection will not always detect a crack in the former, and if detected, you are not sure after reporting a shoe that it will be replaced by a new one. So much roundhouse work nowadays is done with the pencil! As to the latter, possibly grease cups are meant. Pounding rods will break off cups as fast as they are put on. Surely the engineman is not to blame for that. The engine is a "pool" engine; nobody owns it except the company, and the company don't seem to care. In this connection the advice to agents is good: "Chase the people off the platform when a flyer is about to pass"!

J. V. N. CHENEY.

The recent collision caused by a drunken engineman has moved the Prussian Minister of Public Works to issue an order which positively forbids the use of intoxicating drinks while on duty and imposes severe penalties for its violation. The manner in which the temperance movement has spread on the German railroads is notable. But a few years ago the few men who advocated it were looked upon as cranks, and their efforts seemed to be rather discouraged than otherwise by the authorities; now the tendency is all in the other direction, and apparently a trainman known to be a total abstainer will have the preference, and the one who is known to tipple a little will find it hard to keep his place, to say nothing of getting promotion.

New St. Louis Freight Terminals of the Wabash.

The Wabash recently completed and is now occupying large new freight terminals in St. Louis, extending from Franklin avenue on the south to Biddle street on the north and Fourth street on the west to Second street on the east. The Missouri line of



Inbound Freight House of the Wabash at St. Louis.

the Wabash enters St. Louis from two direction by branching at Ferguson, northwest of the city. One line, known as the main line to Union Station, enters from the west side and forms almost exactly an east-and-west center line through the city. This is the line that was used for the shuttle trains during the World's Fair. It is used for through passenger traffic, through business for the West from the Frisco, and for freight service for through cars to

Interior of Inbound Freight House of the Wabash at St. Louis.

and from Cupples station, which serves the commercial interests in its neighborhood.

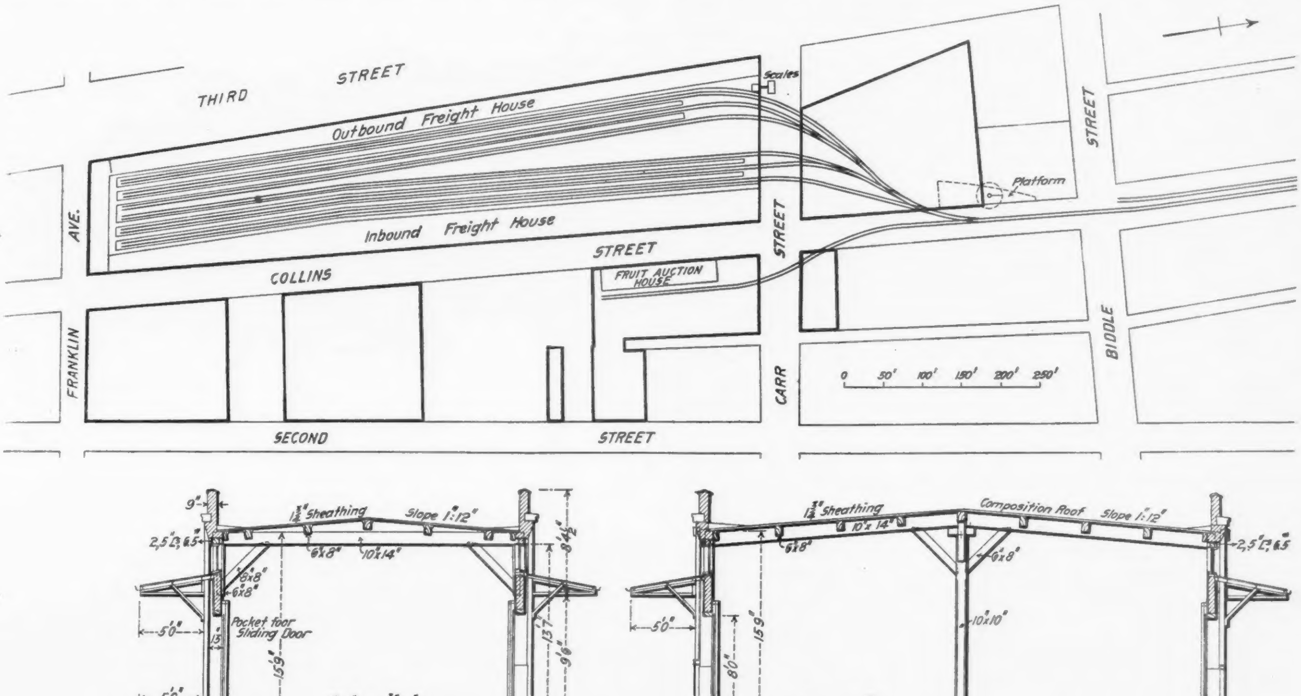
The other line enters the city from the north and approximately parallels and is quite close to the river, running as far as Olive street and the Levee. Considerable suburban business is handled over this line, but the principal function is in connection with freight traffic to and from the west; the freight trains for the west being received and made up at Luther yard, about 5½ miles from Olive street. The line from the East connects with this line by the Merchants' bridge, and also reaches the new terminals over Eads bridge, further south, the freight houses being only about two blocks north of the latter.

Illustrations of the new terminals are shown herewith. They occupy approximately 300,000 sq. ft. of ground close to the heart of the city and are said to provide the most extensive facilities of their kind in St. Louis. The inbound freight house has 81,000

sq. ft. of floor space, including the basement, and the outbound house 22,000 sq. ft. There is track room for about 130 cars and all of the cars on all of the tracks are available to either or both houses. In addition, there is a "fruit auction house" with about 4,400 sq. ft. and two tracks adjoining.

The inbound house is two stories high for 501 ft. of its length and one-story for the remaining 345 ft., with a three-story office portion. The outbound house is one-story high throughout, its construction being similar to the inbound house. Sections through the inbound house are shown herewith to illustrate the details of construction. Referring to the section through the office portion, the foundations are concrete and the columns in the basement are channels. The first floor is cement laid over brick arches sprung between 10-in. I-beams supported by 15-in. 80-lb. I-beams. The building walls are brick, the interior construction above the first floor is timber, and the roof is gravel. The first and second floors are crowned 2 in. Both sides of the house have steel rolling doors. The track side has a 5-ft. platform and both sides a 5-ft. canopy. The one-story portion of the house, which was added after the part just described had been completed, has no basement, the space between foundation walls being filled in. It has a wooden floor, composition roof and sliding doors. The width of this portion reduces from 42 ft. where it adjoins the higher portion, to 24 ft. at the south end, owing to the irregularity of the property.

There are six tracks between the inbound and outbound houses with island platforms 6-ft. wide between tracks except the center two. As already mentioned, there is track room here for about 130 cars. In addition to these facilities the capacity of the team tracks for the delivery and reception of car-load freight at North Market street, about a mile north of the freight houses, has been doubled,



General Plan of Wabash St. Louis Freight Terminal, Showing Elevation and Cross Sections of Freight House.

and the yard enlarged, macadamized and generally improved, putting them in shape to take care of all the car-load business offered, which was formerly handled on both sides of the river. These yards extend from North Market street on the south to Branch street on the north and have ten acres occupied by tracks.

The fruit auction house is across Collins street from the inbound house. It is brick, 30 ft. x 50 ft. This building is a species of produce exchange, controlled by a stock company called "The American Central Fruit Auction Company," organized for the purpose of auctioning fruit for commission dealers, under the direction

of a manager. There is one other similar house in St. Louis, controlled by another company.

The total cost of the terminals, exclusive of the property, was $165,000. We are indebted to Mr. Henry Miller, General Manager, and Mr. A. O. Cunningham, Chief Engineer, for the data.

Railroad Built in 1905.

Table Showing Mileage Built in 1905, Classified by States.

	No. of Cos. building.	1905.	No. of Cos. building.	1904.
Alabama	4	103.08	5	110.64
Alaska	2	13	2	15
Arizona	1	45.47	1	59.66
Arkansas	11	198.51	9	142.43
California	6	34.27	11	191.3
Colorado	4	83.15	5	139.1
Florida	4	10.80	4	54.67
Georgia	6	120	7	119
Idaho	5	109.7	1	13.39
Illinois	8	249.49	7	162.78
Indiana	3	171.79	3	39
Indian Territory	4	98.4	4	150.49
Iowa	3	15.20	2	29
Kansas	2	21.60	1	29
Kentucky	5	76.45	1	20
Louisiana	10	99.30	7	128.61
Maine	2	65.26	2	20
Maryland	1	40.70	1	15.8
Massachusetts	1	1	..	...
Michigan	9	87.76	5	21.7
Minnesota	5	108.29	2	221.49
Mississippi	5	120.5	7	267.93
Missouri	3	48.99	7	270.44
Montana	..	...	2	67.29
Nebraska	1	47	..	...
Nevada	3	86.99	2	176.50
New Jersey	3	9.90	2	7.64
New Mexico	3	122.5	2	10.62
New York	4	49.68	1	2
North Carolina	8	124.5	6	49.2
North Dakota	4	520.75	1	32.85
Ohio	3	84.06	5	83.3
Oklahoma Ter.	3	154.4	4	163.22
Oregon	5	68.42	1	23
Pennsylvania	8	76.7	15	195.85
Rhode Island	1	3.5	..	...
South Carolina	2	28	3	17.3
South Dakota	4	116	1	20
Tennessee	5	151.2	3	98.9
Texas	9	338.5	9	323.28
Utah	5	66.02	2	10
Vermont	1	5	..	...
Virginia	2	13.96	2	12.94
Washington	3	49.50	3	53.31
West Virginia	8	165.23	8	174.78
Wisconsin	7	142.65	5	81.85
Wyoming	2	40.85	1	7
Total, United States	198	4,388.02	172	3,832.26
Canada	11	1,180.86	7	316.39
Mexico	5	238.42	4	115.75

UNITED STATES.

ALABAMA.

Alabama Central—Booth Station to Autaugaville	8.00
Bay Minette & Fort Morgan (L. & N.)—Bay Minette to Foley	36.52
Birmingham Mineral (L. & N.)—Huntsville branch No. 2, from Altoona to Moragne	15.56
Escambia—Florida State line to Camp Eleven	43.00
	103.08

ALASKA.

Alaska Central—Not specified	8.00
Council City & Solomon River—From East Fork of Solomon River to mouth of John's Creek	5.00
	13.00

ARIZONA.

Arizona & California (A., T. & S. F.)—From five miles west of Wickenburg west	45.47

ARKANSAS.

Arkansas & Gulf—Cypress to Arkansas-Louisiana State line	1.20
Bonnerville Southwestern (S. L. & S. F.)—Estico to end of track	3.00
Cherry Valley (S. L. & S. F.)—Halberts to end of track	6.00
Fourche River Valley & Indian Territory—Esau southeast	9.00
Little Rock & Southern (C., R. I. & P.)—Haskells towards Fordyce	35.00
Memphis, Helena & Louisiana (Mo. Pac.)—From Latour south to Watson	56.00
Pine Bluff & Western—Sheridan to Benton	23.00
St. Louis, Iron Mountain & Southern (Mo. Pac.)—Bergman to Arkansas-Missouri State line	18.31
Thornton & Alexandria—Thornton to Calhoun	20.00
Tyronza Central (S. L. & S. F.)—Lepanto to end of track	3.00
Ultima Thule, Arkadelphia & Mississippi—Daleville to Sparkman Junction	24.00
	198.51

CALIFORNIA.

Butte County—Stirling City to Gallagher	7.00
Ione & Eastern—Ione to Martell	12.00
McLoud River—Algoma to Bartle, 4.00 miles; Bartle to end of track, 3.00 miles; total	7.00
Pajaro Valley Consolidated—Spreckles to Buena Vista	5.50
San Francisco & Northwestern (A., T. & S. F.)—End of track to Shively	1.30
San Pedro, Los Angeles & Salt Lake—In Los Angeles	1.47
	34.27

COLORADO.

Colorado & Southern—Wellington to Waverly, 4.80 miles; Wellington to North, 1.20 miles; total	6.00
Denver & Rio Grande—Carbon to Colorado-New Mexico State line	18.15
Denver, Northwestern & Pacific—Arrow to Sulphur Springs	34.00
Great Western—Windsor to Eaton, 13.00 miles; Johnstown to Liberty, 12.00 miles; total	25.00
	83.15

FLORIDA.

Escambia—Century to Florida-Alabama State line	3.00
Florida West Shore—Sarasota to Fruitville	3.80
Jacksonville Terminal—Not specified	1.00
Plant City, Arcadia & Gulf—Keysville to Welcome	3.00
	10.80

GEORGIA.

Atlanta, Knoxville & Northern (L. & N.)—Tennessee-Georgia State line to Cartersville	62.20
Darien & Western—Tibet to Weefanie	15.00
Dublin & Southwestern—Rentz to Eastman	18.00
Georgia Northern of Georgia—Oaklawn to Boston	5.80
Reidsville & Southeastern (D. & W.)—Reidsville to Glenville	16.00
Tallulah Falls—Clayton to Passover	3.00
	120.00

IDAHO.

Malad Valley (O. S. L.)—Utah State line to Malad City	13.60
Minidoka & Southwestern (O. S. L.)—Minidoka to Twin Falls	59.10
Pacific & Idaho Northern—Council to Salmon Junction, 1.25 miles; Council to end of track, 3.75 miles; total	5.00
St. Anthony (O. S. L.)—Elva branch, Elva to Menan, 10.20 miles; Sugar City branch, Sugar City to Snake River, 5.80 miles; total	16.00
Yellowstone Park (O. S. L.)—St. Anthony to Marysville	16.00
	109.70

ILLINOIS.

Chicago & Illinois Western—McCook to Hawthorne, 12.00 miles; Gary to Willow Springs, 3.00 miles; total	15.00
Chicago & State Line (C. & N.-W.)—Lake Bluff north to Illinois-Wisconsin State line	10.30
Chicago Southern (So. Ind.)—Humrick-Chicago line	60.00
Illinois Central—Zeigler toward Herrin	2.00
Illinois, Iowa & Minnesota—Rockford to DeKalb, 37.31 miles; Aurora to Momence, 59.73 miles; total	97.04
Illinois Terminal—Cotters to Le Claire	4.60
Indiana Harbor (L.S. & M.S.)—Danville to Indiana-Illinois State line	8.49
Northern & Southern Illinois (C., B. & Q.)—Centralia to Herron	52.06
	249.49

INDIANA.

Indiana Harbor (L. S. & M. S.)—Indiana-Illinois State line near Danville, Ind., to Osborne	95.79
Indianapolis Southern (Ill. Cent.)—Indianapolis to Unionville	51.00
Southern Indiana—Five miles north of Terre Haute to Indiana-Illinois State line near Humrick, Ill	25.00
	171.79

INDIAN TERRITORY.

Atchison, Topeka & Santa Fe—Owasso to Tulsa	10.28
Midland Valley—Tulsa to Skiatook	15.10
Chicago, Rock Island & Pacific—Colgate to Lehigh	6.52
Missouri, Oklahoma & Gulf—Corretta to Wagoner, 8.20 miles; Muskogee to Dustin, 58.30 miles; total	66.50
	98.40

IOWA.

Chicago, Anamosa & Northern—From a point 2.50 miles southeast of Prairieburg to Coggon	9.20
Colfax Northern—No. 8 Junction to Shaft No. 8	2.00
Newton & Northwestern—Goddard to Colfax	4.00
	15.20

KANSAS.

Denver, Enid & Gulf—Oklahoma-Kansas State line to Kiowa	1.60
Topeka & Northwestern (Union Pac.)—Menoken to Station No. 2	20.00
	21.60

KENTUCKY.

Chesapeake & Ohio—Allendale to Elkhorn	43.00
Cincinnati, Flemingsburg & Southeastern—Johnson to Hillsboro	17.00
Licking Valley—Morgan to Blackwater	6.00
Louisville & Nashville—Cumberland Valley branch, up left fork of Straight Creek	1.45
Southern—Harrodsburg to Danville	9.00
	76.45

LOUISIANA.

Arkansas & Gulf—Arkansas-Louisiana State line south to Laark	5.80
Jasper & Eastern (A., T. & S. F.)—Sabine River to De Ridder	22.50
Kentwood & Eastern—Not specified	2.00
Little Rock & Monroe—Sterlington to Monroe	16.00
Louisiana Nickel Plate—Not specified	2.00
New Orleans, Natalbany & Natchez—From Montpelier north	4.00
New Orleans Terminal—Not specified	5.00
Shreveport, Jonesboro & Natchez—Jonesboro to Gars Mill	12.00
Texas & Pacific—Simmsport to Melville	22.00
Tremont & Gulf—Chatham to four miles south of Beaucoup	8.00
	99.30

MAINE

Northern Maine Seaport—Searsport to South Lagrange, 53.26 miles; Stockton to Cape Jellison, 2 miles; total	55.26
Somerset—Dead Water to Lake Moxie	10.00
	65.26

MARYLAND.

Western Maryland—Hancock west toward Cumberland	40.70

MASSACHUSETTS.

Boston & Maine—East Deerfield, connecting the Connecticut River and Fitchburg divisions	1.00

MICHIGAN.

Boyne City, Gaylord & Alpena—Camp 10 to Gaylord	15.00
Chicago & North-Western—Wisconsin-Michigan State line to Saunders	0.91
Escambia & Lake Superior—Not specified	6.00
Grand Rapids Terminal (Grand Trunk)—In Grand Rapids	1.52
Manistee & Grand Rapids—Section 28 in Osceola County to Marion	6.96
Manistique—Diller to Curtis	6.00
Marquette & South Eastern—West Yard to Big Bay	24.00
*Michigan Central—Kalamazoo to Lawton	15.31
Michigan Central—Logging branches	4.00
Munising—East branch, northeast to Cousino	8.06
	87.76

MINNESOTA.

Duluth & Northern Minnesota—Beaver to point two miles north of North Branch Junction, 6.00 miles; North Branch Junction to point two miles beyond Swan Toole, 7.00 miles; total	13.00
Duluth, Missabe & Northern—Keenan to Sherwood	8.04
Great Northern—Red Lake Falls to Dugdale, on Duluth-Crookston line	15.00
Minneapolis, Red Lake & Manitoba—Bemidji to Nebish	26.25
Minneapolis, St. Paul & Sault Ste. Marie—Thief River Falls west to Red River	46.00
	108.29

MISSISSIPPI.

Gulf & Ship Island—Silver Creek branch, Silver Creek south, 8.00 miles; Columbia north, 3.00 miles; total	11.00

*Change in location of old main line.

Mississippi Central—Silver Creek west to Pearl river	7.50
Mobile, Jackson & Kansas City—Newton to Noxapater, 43.50 miles; Ackerman to Houston, 35.00 miles; Decatur Junction to Decatur, 1.50 miles; total	80.00
Natchez, Columbia & Mobile—Roonville east	2.00
Yazoo & Mississippi Valley—Hendon south, 2.00 miles; Webb toward Parchman, 1.00 mile; Helm northwest, 7.00 miles; Silver City toward Kelso, 10.00 miles; total	20.00
	120.50

MISSOURI.

Missouri Southern—Crab Tree branch, Crab Tree to Pinedale, 13.00 miles; Corridon branch, Corridon to Jackson, 9.00 miles; total	22.00
St. Louis, Iron Mountain & Southern—Galena to Arkansas-Missouri State line, 21.69 miles; Thebes bridge approaches, 3.91 miles; total	25.60
Union Terminal—Extension to Lake Contrary	1.39
	48.99

NEBRASKA.

Great Northern—Sioux City-Ashland line (C., B. & Q. connection)	47.00

NEVADA.

Nevada & California (formerly Carson & Colorado) (So. Pac.)—Fort Churchill to Hazen	27.99
San Pedro, Los Angeles & Salt Lake—Borax to Bard	24.00
Tonopah & Goldfield—Tonopah to Goldfield	35.00
	86.99

NEW JERSEY.

Central of New Jersey—Spur to Brill street, Newark, 0.36 miles; in Bayonne, 0.60 miles; total	0.96
Lehigh Valley—Elizabeth to Irvington	2.94
Rahway Valley—Kenilworth to Summit	6.00
	9.90

NEW MEXICO.

Denver & Rio Grande—Colorado-New Mexico State line to Farmington	29.50
Eastern Railway of New Mex. (A., T. & S. F.)—Texico to Brazil Springs, 51.00 miles; Llano to Montencino, 14.00 miles; Willard west, 16.00 miles; Sais toward Abo Canyon, 2.00 miles; total	83.00
Santa Fe, Raton & Eastern—Raton east	10.00
	122.50

NEW YORK.

Buffalo & Susquehanna—Wellsville to Caneadea, 26.00 miles; Sandusky to Yorkshire, 7.00 miles; total	33.00
Delaware & Eastern—Arkville to Union Grove	10.00
Delaware & Hudson—Warrensburg to Thurman	3.40
Glen Cove (Long Island)—Sea Cliff Station to Glen Cove Harbor	3.28
	49.68

NORTH CAROLINA.

Atlantic & Western—Jonesboro to Broadway	7.00
Bee Tree—Swannanoa to Craggy Mountain	5.00
Caldwell & Northern—Collettsville to Edgemont	14.00
Durham & South Carolina—Durham southwest	30.00
Durham & Southern—Apex to Durham	21.00
Raleigh & Pamlico Sound—Raleigh east towards Wilson	12.50
Raleigh & Southport—Lillington south toward Fayetteville	6.00
Wellington & Powellsville—Windsor to Plymouth	29.00
	124.50

NORTH DAKOTA.

Farmers' Grain & Shipping Company—Starkweather to Hansboro	42.00
Great Northern—York branch, York to Thorne, 34.35 miles; Towner branch, Towner to Maxbass, 45.89 miles; Bottineau branch of the Minot division, Westhope west to Antler, 12.75 miles; Lakota branch, Munich to Sarles, 20.53 miles; Davenport to Chaffee, 7.00 miles; total	120.52
Minneapolis, St. Paul & Sault Ste. Marie—Red River west to Kenmare, 251.00 miles; Egeland to Armourdale, 20.00 miles; Underwood to Garrison, 19.50 miles; total	290.50
Northern Pacific—Denhoff to Turtle Lake, 27.85 miles; Edgeley to Streeter, 39.88 miles; total	67.73
	520.75

OHIO.

Baltimore & Ohio—Haselton to Niles, 8.52 miles; Niles to Cuyahoga Falls, 41.50 miles; total	50.02
Cincinnati, Georgetown & Portsmouth—Georgetown to Russellville, 7.00 miles; Cincinnati to Coney Island, 3.50 miles; total	10.50
Toledo & Indiana—Wauseon to Bryan, 22.33 miles; Wauseon to sidings, 1.21 miles; total	23.54
	84.06

OKLAHOMA TERRITORY.

Denver, Enid & Gulf—Coldwater via Cherokee to Oklahoma-Kansas State line	46.40
Kansas City, Mexico & Orient—Fairview to Custer City	50.00
Midland Valley—Skiatook to Foraker	58.00
	154.40

OREGON.

Columbia River & Oregon (O. R. R. & N.)—Arlington to Condon	45.00
Louisiana & Pine Bluff—Not specified	3.00
Oregon & Eureka—Luffenholtz to Camp 13, 1.20 miles; on extension from Eureka toward Arcata, 2.50 miles; total	3.70
Oregon State Portage—Celilo to Big Eddy	8.50
Sumpter Valley—Tipton to Austen	8.22
	68.42

PENNSYLVANIA.

Buffalo & Susquehanna—Juneau to Sagamore	20.00
Buffalo, Rochester & Pittsburg—Rockton to coal mines	3.00
East Broad Top—Rocky Ridge to Evanston	5.00
Lancaster, Oxford & Southern—Fairmount to Quarryville	7.00
Northampton & Bath—Northampton to Bath	21.00
Pennsylvania—Cambria & Clearfield division, Possom Glory Junction to Clymer	4.00
Pittsburg, Summerville & Clarion—Waterson west through Bush Run	2.00
Western Allegheny (B. & L. E.)—Queen Junction to Rose Point	14.70
	76.70

RHODE ISLAND.

Newport & Wickford—Wickford Landing to Wickford Junction	3.50

SOUTH CAROLINA.

Conway Coast & Western—Conway to Cool Spring	12.00
Union & Glenn Springs—Prides to Union	16.00
	28.00

SOUTH DAKOTA.

Chicago, Milwaukee & St. Paul—Armour to Stickney, 20 miles; Madison to Saranac, 11 miles; total	31.00
Missouri River & Northwestern—Rapid City west towards Mystic	20.00
South Dakota Central—Colton to Wentworth	25.00
White River Valley (C., M. & St. P.)—Chamberlain to Presho	40.00
	116.00

TENNESSEE.

*Atlanta, Knoxville & Northern (L. & N.)—Knoxville to Etowah	59.00
Atlanta, Knoxville & Northern (L. & N.)—Etowah to Tennessee-Georgia State line toward Cartersville, Ga.	16.00
Cincinnati, New Orleans & Texas Pacific—Cardiff to Tennessee river	5.50
Little River—Not specified	18.00
*Louisville & Nashville—Henderson division, Goodlets to Greenbrier	8.70
Louisville & Nashville—Knoxville division, Byington to Wind Rock.	26.00
Tennessee—Jakes branch to Buffalo Creek	8.00
Virginia & Southwestern—Taylor Mines branch, Rexford to Baladeen	10.00
	151.20

TEXAS.

Beaumont & Great Northern—Trinity east	4.00
Houston & Texas Central—Mexia south	1.00
Jaspeh & Eastern (A., T. & S. F.)—Kirbyville to Sabine River	17.50
Kansas City, Mexico & Orient—Between Sweetwater and Knox City	75.00
Northeast Texas—Red Water to Daingerfield	14.00
Orange & Northwestern—Buna to Newton	31.00
St. Louis, Brownsville & Mexico—From a point 3.50 miles north of Robstown to Bay City, 139.00 miles; Algoa to Brazoria, 32.00 miles; total	171.00
Texas & Gulf—Timpson to Watterman	16.00
Texas Southeastern—Diboll to Naches river	9.00
	338.50

UTAH.

Malad Valley (O. S. L.)—Garland to Idaho State line	18.30
Oregon Short Line—Logan branch, Logan Sugar Works to Wellsville	8.40
Rio Grande Western—Roy to Hooper, 4.05 miles; Bingham branch, Garfield Junction to Garfield, 16.20 miles; total	20.25
Salt Lake & Ogden—Lagoon to Kaysville, 3.75 miles; Kaysville to Layton, 2.25 miles; total	6.00
*San Pedro, Los Angeles & Salt Lake—Modena to Morton, 10.74 miles; at Goss, 2.33 miles; total	13.07
	66.02

VERMONT.

Bethel Granite—Bethel to quarries	5.00

VIRGINIA.

Norfolk & Western—Big Creek branch, from above Richlands to coal fields in Tazewell County, 5.96 miles; Speedwell extension from Cripple Creek, 1.00 mile; total	6.96
Tidewater—Algren to Suffolk	7.00
	13.96

WASHINGTON.

Columbia & Puget Sound—Walsh to Rock Creek	2.75
Northern Pacific—Main line junction switch to Granger	2.75
Spokane Falls & Northern (Gt. Nor.)—International boundary line near Midway, B. C., west to 5.00 miles south of recrossing into British Columbia	44.00
	49.50

WEST VIRGINIA.

Chesapeake & Ohio—Leewood to Coal River extension of Cabin Creek branch, 12.00 miles; Station 664 on Rainey Creek branch, 3.00 miles; Bartow to Winterburn, 3.00 miles; total	18.00
Coal & Coke—Adrian to Gassaway	50.20
Coal River—Holleyhurst to Bull Creek	5.00
Deepwater—Blake to Fetzer	43.00
Iager & Southern (N. & W.)—Ritter up Dry Fork of Tug River to Berwind-White coal fields	20.00
Meadville & Somerville—From Strange creek	10.00
Norfolk & Western—Clear Fork branch from Gordon	10.43
Western Maryland—Between short arms of Potomac River	8.60
	165.23

WISCONSIN.

Chicago & North-Western—From a point six miles north of Laona to Wisconsin-Minnesota State line, 28.62 miles; Mercer to Foster-ville, 20.49 miles; total	49.11
Chicago, St. Paul, Minneapolis & Omaha (C. & N.-W.)—Winter to Draper	10.00
La Crosse & Southeastern—Stoddard to La Crosse	11.80
Manitowoc, Green Bay & North-Western (C. & N.-W.)—Manitowoc north	16.74
Milwaukee & State Line (C. & N.-W.)—Between Wisconsin-Illinois State line and St. Francis, north and south of Bain	6.25
Owen & Northern (Wis. Cent.)—Owen to Ladysmith	42.50
Stanley, Merrill & Phillips—Jump river to Lynch	6.25
	142.65

WYOMING.

Chicago, Burlington & Quincy—Spur track from Junction one-half mile east of Guernsey station	8.85
Wyoming & North-Western (C. & N.-W.)—Casper west	32.00
	40.85

CANADA.

Algoma Central & Hudson Bay—Mile-post 66 to Mile-post 69.25	3.25
Brandon, Saskatchewan & Hudson Bay—Not specified	7.00
Canadian Northern—Arizona Junction, Man., to Carberry Junction, Man., 74.00 miles; main line, Kamsack, Assin., west via Humboldt and Battleford, Sask., to Edmonton, Alberta, 527.00 miles; total	601.00
Canadian Pacific—Lipton to end of track, 65.00 miles; Wetaskiwin to Daysland, 50.00 miles; Lacombe to end of track, 50.00 miles; Brookdale to Varcoe, 18.00 miles; Darlingford to Kaleida, 6.00 miles; Reston to Wawota, 60.00 miles; Lander to Broomhill, 20.00 miles; Yahk to international boundary, 8.00 miles; total	277.00
Great Northern of Canada—St. Jacques Junction to St. Jacques	7.20
Halifax & Southwestern—Halifax to Liverpool, Nova Scotia	112.00
Klondike Mines—Dawson City to Grand Forks	13.00
Quebec & Lake St. John—Valcartier west, 3.00 miles; La Tuque Junction west, 12.00 miles; total	15.00
Quebec Bridge & Railway Company—Quebec across the St. Lawrence River to a point on the Intercolonial (except bridge)	9.41
Spokane Falls & Northern (Great Northern)—Grand Forks, B. C., to Phoenix	23.00
Temiskaming & Northern Ontario—North Bay, Ont., to Liskeard	113.00
	1,180.86

MEXICO.

Chihuahua & Pacific—La Junta to Temosachic	55.00
Inter California (So. Pac.)—Calexico south	14.27
Kansas City, Mexico & Orient—Chihuahua division, Las Trancas to San Sostenes, 41.00 miles; between the Guerrero River and Bocoyna, 50.00 miles; Pacific Coast division, between Fuerte and Las Hornillos, 10.00 miles; total	101.00
Linares & Gulf—Linares toward San Jose	6.00
Pan-American—Tonala, State of Chiapas, to Coapa	62.15
	238.42

*Change in location of old main line.

Proposed Increase in the Variation in the Height of Couplers.

At the October meeting of the Western Railway Club, Mr. J. J. Hennessey, of the Chicago, Milwaukee & St. Paul, introduced a topical discussion in which it was proposed to increase the variation allowed in the height of couplers. The present variation of 3 in. between the maximum and minimum height of M. C. B. couplers from top of rail does not seem to be sufficient. The standard height of 33 in. was established back in the 70's. At that time the railroads had their cars equipped with link and pin drawbars. Some of the wrought iron and Safford drawbars and others had very small openings in the mouth and it was very difficult to couple one car to the other by switchmen stepping in between the cars and attempting to enter the link of one drawbar, into the mouth of the opposite drawbar with safety to themselves, when the variation in height of the two drawbars was more than 3 in. That was the reason the M. C. B. Association established a variation of 3 in. between the maximum and minimum height of center line of drawbars from top of rail.

A few years afterward the vertical plane coupler, or what is commonly called the Master Car Builders' coupler, was adopted. At that time the knuckles had a wearing surface on the face of about 8 in., some less, some a little more, with an opening of about 2 in. in the center. The Master Car Builders' Association and railroad men generally discussed the advisability of allowing more variation between the maximum and minimum height of cars, but the objections were that in the majority of cases the lower lug of the knuckle was not over 2¾ in. wide, and they felt that with a greater variation, the tendency would be toward having all the pulling and buffing done on either the upper or the lower lug when a high car and a low car came together in switching, and thereby cause either lug to break off, and cause serious delays. But since that time things have changed. All railroads to-day are buying the solid knuckle with a 9-in. wearing face, while some of the larger roads are using knuckles having a wearing surface of 10 in., and the knuckle is solid, consequently the danger of breaking off the upper or lower lugs is no longer present.

At interchange points there is great delay in cars being sent back, especially by the belt lines which do the bulk of passing cars from one road to another, on account of the cars being higher or lower than the present prescribed limits. This is expensive to the railroads; while on the repair tracks it will be found that car repairers are continually raising old cars.

It is quite true that there is a law prescribing the 3-in. limit but the railroad companies and the Master Car Builders' Association are responsible for the law, for it was upon their recommendation that it was passed.

Viewing the matter from a practical standpoint, some figures are presented showing the actual settlement of cars. Wear on journal bearings, ⅜ in.; wear on journals, ¼ in.; wear on wheels, ¼ in.; wear on carry iron and bottom of M. C. B. coupler, ½ in. (that is, ¼ in. each); settlement of arch bars, ¼ in. It is well known that there are very few cars in service to-day that were built five or six years ago under which the arch bars do not have a tendency to bend up, and this ¼ in. is quite insufficient to represent it. Permanent set of springs was ¼ in. to ⅜ in. Difference of springs between empty and loaded cars, 1½ in. Set of overhang of car, ⅜ in.; that is, from the bolster to the end of the car. This is taken at ⅜ in. though in many old cars it amounts to as much as 1 in.; while some weak flat cars bend up an inch. The total according to these figures is 4⅛ in. There is nothing overdrawn in this; in fact, it is not sufficient, as it is not as much as really takes place in service.

Observations on one of the worst divisions of the Chicago, Milwaukee & St. Paul showed that the up and down movement of the couplers was not more than 2 in. though, of course, there is a greater variation in yards. But with the knuckle from 9 in. to 10 in. wide at least 1 in. more of variation can safely be recommended between the maximum and minimum heights. That would make it possible to build new cars 35 in. high, and the car would not be condemned or refused until it had dropped below 31 in. The settlement of new cars is sometimes great, and often amounts to as much as 1 in. after the first thousand miles.

The total allowable variation to-day under the present Master Car Builders' rules and under the Interstate Commerce Rules is 3 in., and when there is a settlement of 2 in. when a car is loaded there is but 1 in. of variation left. In short this is accountable for much more expense in the way of car repairs than many are aware of.

In the course of the discussion following the opening remarks, it was urged that 4 in. was not enough; it should be 5 in., for the reason that with a knuckle with a 10-in. face there would still be 5 in. of knuckle surface to pull on. Regarding this latter recommendation there was some variation of opinion, though it was well agreed that there should be an increase in the amount now allowed. The discussion closed with the adoption of a resolution urging the Master Car Builders' Association to consider the matter with a view of allowing greater variation than at present.

A New Oil Pumping Process.

The Southern Pacific is soon to make a test of a new pipe line pumping process for crude oil, which is expected to greatly reduce the cost and difficulty of pumping long distances. A special 8-in. pipe line 31 miles long has been laid from Volcan Siding in the Kern river oil fields to Delano, Cal., and a pumping plant consisting of three 200-h.p. boilers and a Dow compound duplex steam pump with a capacity of 1,000 gallons of oil a minute, has been installed at Volcan.

The pipe line is laid with 8-in. standard pipe made by the National Tube Co., corrugated on the inside with six grooves, each 3/64 in. deep and ½ in. wide, each groove making two complete turns in a 20-ft. length of pipe. The pipe is corrugated by a special process developed by Mr. J. D. Isaacs, Asst. Eng. Maintenance of Way, Southern Pacific. A plant for corrugating the pipe has been built near Bakersfield, Cal., on the side of a hill, and the pipe is rolled by gravity through the various processes from the time it is unloaded from the cars until it is loaded on cars again. The corrugating machine makes the pipes somewhat polygonal in shape and careful tests are made to discover any defects. Each length of pipe is tested with 1,200 lbs. of water pressure, both before and after corrugating. This testing is done by the Pittsburg Testing Laboratory and Robert W. Hunt & Co., and only selected lengths are used. Each length is weighed and measured and a separate record is kept of it.

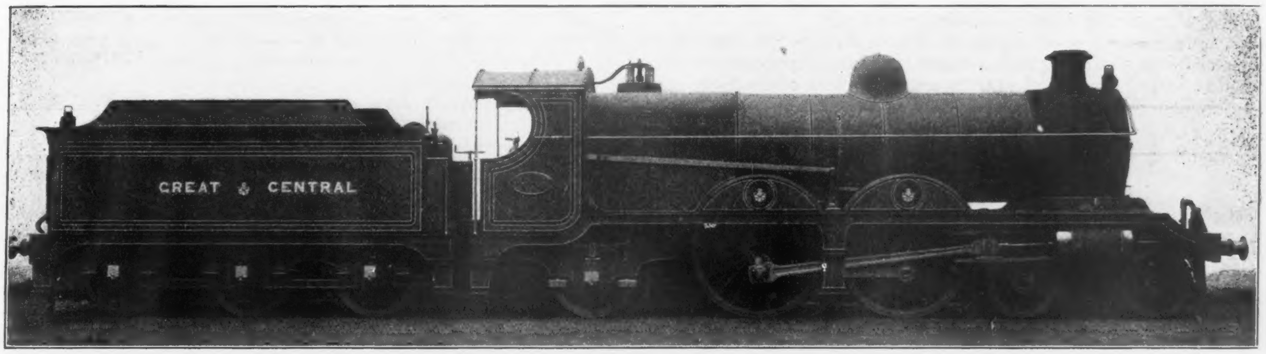
In operation water is pumped into the pipe with the oil in sufficient quantities to form a shell around the oil which does not come in contact with the surface of the pipe. The grooves cause the water and oil to advance through the pipe with a rotary motion, and it is claimed that with this process oil can be pumped as easily as water. At the outlet a centrifugal separator removes the water from the oil. The pipe line is laid with depressions or traps every 400 ft. These traps prevent the pipe from running entirely dry in case the pumping stops and assist in getting the stream of oil surrounded with water under way again. If the tests to be made prove the new system to be successful it will probably be adopted on a large scale on the Coast.

Recent Heavy Locomotive Equipment of the Great Central Railway of England.

Within the last few years the Great Central has become one of the most active and progressive lines in England operating at the present time about 600 miles in the manufacturing country north of London and reaching Leicester, Nottingham, Sheffield and Manchester. About five years ago an entrance into London was obtained over the tracks of the Metropolitan between Quainton Road and Finchley. This stretch of track, however, was full of curves and the traffic over it was badly congested so that the line was unsuited for the operation of heavy and fast express trains. Shortly after the trackage rights were secured from the Metropolitan, the Great Central and the Great Western acting together obtained the necessary parliamentary sanction for the construction of a new line with favorable grades and few curves from Grendon Underwood to Neasden, 46 miles, which gives to both roads a fine entrance into London. Work was begun on the new line two years ago and it was thrown open for goods traffic early in November. It is expected to have the line in shape for the operation of passenger trains by March, 1906.

A considerable freight and suburban passenger business is expected over the new line as well as fast express service to the northern cities, and in anticipation of this the motive power department of the Great Central has designed and had built a number of locomotives for each of these classes of service.

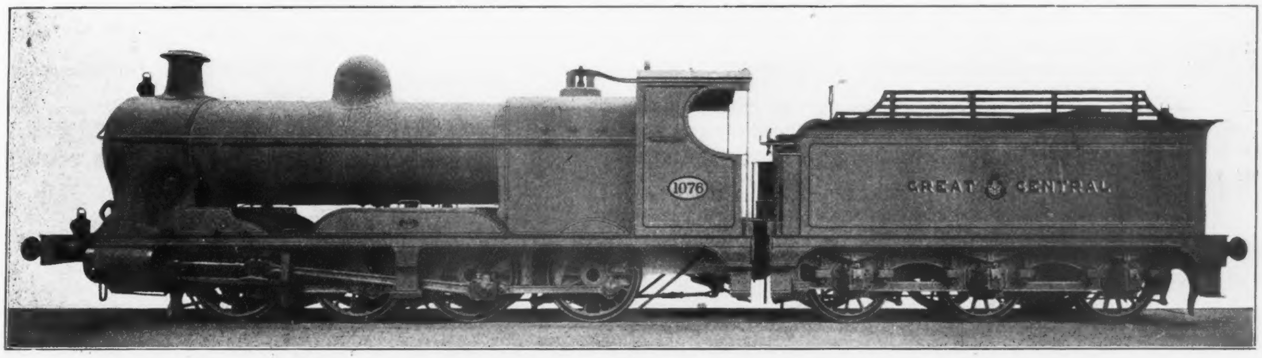
The Atlantic (4-4-2) type engines were built by the North British Locomotive Company, Ltd., of Glasgow, and will be put in service on the most important express trains out of London. The cylinders, which are placed outside the frames in accordance with American practice, are 19½ in. x 26 in., and are inclined downward 1 in 48. The driving wheels are 81 in. in diameter with cast-steel centers. The trailing wheels are quite large, 51 in. in diameter, as are also the tender wheels. The forward truck wheels are 42 in. in diameter. The boiler has a Belpaire firebox, and both the shell and firebox are formed of steel plates. A working pressure of 200 lbs. is employed and the boiler has 1,931.3 sq. ft. of heating, of which 1,777.9 sq. ft. is contained in the 221 tubes, 2 in. in diameter and 15 ft. long. The firebox contains 153.4 sq. ft. of heating surface and has a grate area of 26 sq. ft. The frames are steel plate 1¼ in. thick and are bent in at the forward end to provide room for the cylinders and forward truck. In the front-end an inside stack and petticoat pipe are provided and the blast pipe



Atlantic (4-4-2) Type Express Locomotive—Great Central Railway of England.

supports a perforated dished plate spark arrester and perforated plate deflector. The forward truck has 1¼ in. of side play in the bolster controlled by heavy laminated springs, and the trailing truck has boxes of the Cartazzi type. The valves are of the balanced slide valve type with Stephenson link motion. The tender has a capacity of 4,000 gallons of water and 6½ tons of coal. A novel form of water scoop for taking water from track tanks is used, the scoop being raised and lowered with a steam cylinder moving a lifting screw.

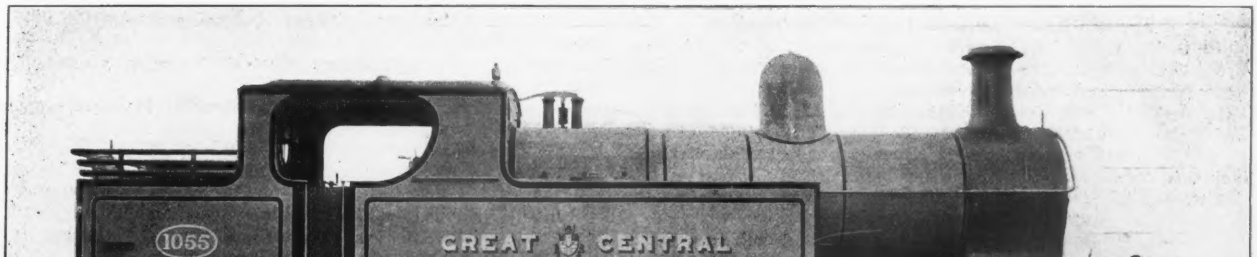
The heavy freight locomotives which will be put in service between London, Sheffield and Manchester and Grimsby Docks are of the 0-8-0 type, and were built by Kitson & Co., Ltd., of Leeds. The cylinders are mounted outside of the frames and have a diameter of 19½ in. with 26-in. stroke. The eight wheels are 55 in. in diameter and the engine has a rigid wheel base of 17 ft. 1 in. The boiler is of the Belpaire type, 15 ft. long over tube sheets and 4 ft. 9 in. diameter, outside, with its center line 8 ft. 3 in. above the rails. It contains 1,764.9 sq. ft. of heating surface, of which 1,625 sq. ft. is in the tubes 202 in number and 2 in. in diameter. The firebox contains 139.9 sq. ft. of heating surface and has a grate area of 23.6 sq. ft. In working order the engines weigh 142,800 lbs., all on drivers, and the tender when loaded weighs 95,536 lbs., giving a total weight of engine and tender of 238,333 lbs. The engines are equipped with automatic vacuum brake apparatus.



Heavy Freight Locomotive for the Great Central Railway of England.

For heavy suburban service the tank locomotives shown in the illustration have been designed and a number of these have been built by the Vulcan Foundry, Ltd., Newton-le-Willows, Lancashire. These engines have inside cylinders 18 in. x 26 in., driving two pairs of coupled wheels 67 in. in diameter. The boiler is designed for a working steam pressure of 160 lbs. and contains 1,065 sq. ft. of heating surface. Of this amount, 955 sq. ft. are in the tubes and 110 sq. ft. in the firebox, which has a grate area 19.85 sq. ft. The total wheelbase of the engines is 29 ft. 10½ in., and their length over buffers is 40 ft. 9½ in. The side tanks have a capacity of 1,450 gallons of water. At 90 per cent. of the boiler pressure the engines have a tractive effort of 18,107 lbs. Their weight in working order is 151,760 lbs.

These engines were all built from the designs of Mr. John G. Robinson, M. Inst. M. E., Chief Mechanical and Marine Superintendent of the Great Central, to whom we are indebted for the illustrations and description.



Tank Locomotive for Suburban Service—Great Central Railway of England.

Important Changes in Railroad Officers During 1905.

The following list of official changes during the past year is not intended to be complete, but to show the more important executive appointments. The record reflects, as well, many of the most striking happenings in the railroad history of the year.

Atchison, Topeka & Santa Fe.
April—H. U. Mudge, General Manager, resigned. (See Chicago, Rock Island & Pacific.)
—J. E. Hurley, General Superintendent of the Eastern grand division, appointed General Manager.
November—E. D. Kenna, First Vice-President, resigned.

Atlantic Coast Line.
March—W. N. Royall, General Superintendent, appointed General Manager.
November—R. G. Erwin, President, resigned.
—T. M. Emerson, Third Vice-President, elected President.
December—J. R. Kenly, Fourth Vice-President, elected Third Vice-President.

Baltimore & Ohio.
February—C. S. Sims, General Manager, resigned.
—T. Fitzgerald, General Superintendent, appointed General Manager.

Central of Georgia.
January—T. S. Moise, General Superintendent, appointed General Manager.

Central Vermont.
January—E. H. Fitzhugh, Vice-President and General Manager, resigned. (See Grand Trunk.)
—G. C. Jones, Superintendent of the Middle division of the Grand Trunk, appointed General Manager.

Chicago & Eastern Illinois.
February—R. R. Hammond, Second Vice-President and General Manager, resigned.
—H. I. Miller, General Manager of the Chicago, Rock Island & Pacific, elected Second Vice-President and General Manager.

Chicago, Burlington & Quincy.
January—J. M. Gruber, General Superintendent of the Union Pacific, appointed General Manager of the lines east of the Missouri river.

Chicago Great Western.
September—S. C. Stickney, General Manager, elected also Second Vice-President.
—L. S. Cass, Assistant to the General Manager, elected Third Vice-President.

Chicago, Milwaukee & St. Paul.
September—E. W. McKenna, Assistant to the President, elected Second Vice-President.
October—H. R. Williams, General Manager, resigned. (See Pacific Railroad.)
November—W. J. Underwood, Assistant General Manager, appointed General Manager.

Chicago, Rock Island & Pacific.
February—W. B. Biddle, Freight Traffic Manager of the Atchison, Topeka & Santa Fe, elected Third Vice-President.
—H. I. Miller, General Manager, resigned. (See Chicago & Eastern Illinois.)
April—J. F. Stevens, Second Vice-President, resigned. Appointed, in July, Chief Engineer of the Panama Canal.
—H. U. Mudge, General Manager of the Atchison, Topeka & Santa Fe, elected Second Vice-President.
June—F. O. Melcher, General Superintendent of the Choctaw district, appointed General Manager of the Central and Northern districts.
—D. E. Cain, General Superintendent of the Eastern grand division of the A., T. & S. F., appointed General Manager of the Southwestern and Choctaw districts.

Cincinnati, Hamilton & Dayton.
May—J. A. Edson, General Manager, resigned. (See Kansas City Southern.)
—R. H. Bowron, Superintendent of the North and South divisions, appointed General Manager of the C., H. & D. and Chicago, Cincinnati & Louisville.
September—Eugene Zimmerman, President, resigned. (See Detroit, Toledo & Ironton.)
October—F. D. Underwood, President of the Erie, elected also President of the C., H. & D., Pere Marquette and C., C. & L.
November—Authority of the Vice-Presidents of the Erie extended over the C., H. & D., Pere Marquette and C., C. & L.
December—Judson Harmon appointed Receiver of the C., H. & D. and the Pere Marquette.

Cleveland, Akron & Columbus.
February—J. F. Miller, Vice-President, retired on a pension.

Cleveland, Cincinnati, Chicago & St. Louis.
January—M. E. Ingalls, President, elected Chairman of the Board.
—W. H. Newman, President of the N. Y. C. & H. R., elected President.
—E. V. W. Rossiter, W. C. Brown, John Carstensen and G. J. Grammer elected Vice-Presidents.

Colorado & Southern.
October—A. D. Parker, General Auditor, elected Vice-President.
December—J. M. Herbert, Vice-President and General Manager, elected First Vice-President.
—A. D. Parker, Vice-President, elected Second Vice-President, in charge of operating, traffic and accounting departments.
—J. H. Young, General Superintendent, appointed General Manager.

Cumberland Valley.
September—A. J. Cassatt, President of the Pennsylvania, elected President, succeeding T. B. Kennedy, deceased.

Denver & Rio Grande.
March—A. C. Ridgway, General Manager of the Denver, Northwestern & Pacific, appointed General Manager.

Detroit, Toledo & Ironton.
June—G. M. Cumming elected President, succeeding Samuel Hunt, deceased.
—R. K. Smith, Superintendent on the St. Louis, Iron Mountain & Southern, appointed General Manager.
July—F. A. Durban elected President.
—B. S. Warren elected Vice-President.
September—F. A. Durban, President, elected also President of the Ann Arbor, succeeding Joseph Ramsey, Jr., resigned.
November—Eugene Zimmerman elected President, succeeding F. A. Durban, resigned.
December—F. A. Durban elected Vice-President.

El Paso & Southwestern System.
May—H. J. Simmons, General Superintendent and Traffic Manager, appointed General Manager.
July—James Douglas elected President.
—A. C. James elected Vice-President.

Erie.
October—Russell Harding, First Vice-President of the C., H. & D., elected Vice-President of the Erie.
November—Russell Harding, Vice-President, resigned.

Georgia, Southern & Florida.
June—S. F. Parrott, Chairman of the Southeastern Freight Association, elected Vice-President and General Manager.

Grand Trunk.
January—E. H. Fitzhugh, Vice-President and General Manager of the Central Vermont, elected Third Vice-President, succeeding F. W. Morse, resigned. (See Grand Trunk Pacific.)
—F. H. McGuigan, Manager, elected Fourth Vice-President.

Grand Trunk Pacific.
January—F. W. Morse, Third Vice-President of the Grand Trunk, elected Vice-President and General Manager.

Harriman Lines.
May—W. B. Scott, General Superintendent of the Houston & Texas Central, appointed Assistant Director of Maintenance and Operation, succeeding B. A. Worthington. (See Oregon Railroad & Navigation.)

Illinois Central.
February—W. J. Harahan, General Manager, elected Fourth Vice-President.
—I. G. Rawn, Assistant General Manager, appointed General Manager.

Kansas City Southern.
May—J. A. Edson, General Manager of the C., H. & D., elected President.
June—William Coughlin, General Superintendent of the Denver & Rio Grande, appointed General Manager.
July—H. R. Duval elected Vice-President.

Lake Shore & Michigan Southern.
February—G. J. Grammer, General Traffic Manager, elected Vice-President in charge of traffic of New York Central Lines west of Buffalo.

Lehigh Valley.
September—J. W. Platten, Second Vice-President, resigned.

Long Island.
January—W. F. Potter, Vice-President and General Manager, elected President, succeeding W. H. Baldwin, Jr., deceased.
April—Ralph Peters, General Superintendent of the Southwest

system of the Pennsylvania Lines West, elected President, succeeding W. F. Potter, deceased.

Louisville & Nashville.

February—W. L. Mapother, Assistant to the President, elected First Vice-President.

June—W. J. Dickinson, Third Vice-President, resigned.

July—A. R. Smith, General Freight and Passenger Agent of the Atlanta & West Point, elected Third Vice-President.

Mexican Central.

June—C. R. Hudson, President of the San Antonio & Aransas Pass, elected Vice-President.

Michigan Central.

January—H. B. Ledyard, President, appointed Chairman of the Board, succeeding C. M. Depew.

—W. H. Newman, President, and W. C. Brown, John Carstensen and C. J. Grammer, Vice-Presidents of the N. Y. C. & H. R., elected to the same positions on the Michigan Central.

Minneapolis, St. Paul & Sault Ste. Marie.

August—E. Pennington, Second Vice-President, elected First Vice-President, succeeding John Hamilton, deceased.

—W. L. Martin, Freight Traffic Manager, elected Second Vice-President.

Mobile, Jackson & Kansas City.

May—F. E. Dewey, Vice-President and General Manager, resigned.

—A. McDonald elected Vice-President.

—T. P. Whittelsey appointed General Manager.

September—A. McDonald, Vice-President, resigned.

—G. J. Kobush elected Vice-President.

National of Mexico.

April—J. G. Metcalfe, First Vice-President, resigned.

—J. S. MacKie, Second Vice-President, resigned.

—D. P. Bennett, Assistant to the President, elected Vice-President, with duties of former Vice-Presidencies.

New York Central & Hudson River.

February—N. Guilford, Traffic Manager, elected Vice-President in charge of traffic of New York Central Lines east of Buffalo.

Norfolk & Western.

February—W. G. Macdowell, Treasurer, elected Vice-President.

Northern Pacific.

June—C. M. Levey, Assistant to the President, elected Third Vice-President.

August—J. N. Hill elected Vice-President, succeeding D. S. Lamont, deceased.

Oregon Railroad & Navigation.

February—B. A. Worthington, Assistant Director of Maintenance and Operation of the Harriman Lines, appointed General Manager of the O. R. R. & N. and Southern Pacific lines in Oregon, succeeding E. E. Calvin. (See Southern Pacific.)

April—B. A. Worthington, General Manager, elected also Vice-President.

May—B. A. Worthington, Vice-President, resigned. (See Wabash-Pittsburg Terminal.)

June—J. P. O'Brien, General Superintendent, appointed General Manager of the O. R. R. & N. and Southern Pacific lines in Oregon, Washington and Idaho.

July—J. P. O'Brien elected also Vice-President.

Pacific Railroad.

October—H. R. Williams, General Manager of the Chicago, Milwaukee & St. Paul, elected President.

Panama.

April—T. P. Shonts, President and General Manager of the Toledo, St. Louis & Western, elected also President.

—J. F. Wallace elected Vice-President and General Manager.

July—J. F. Stevens appointed General Manager, succeeding J. F. Wallace, resigned.

Pennsylvania.

October—Samuel Rea, Fourth Vice-President, elected Third Vice-President, succeeding S. M. Prevost, deceased.

—J. B. Thayer, Fifth Vice-President elected Fourth Vice-President.

—H. Tatnall, Sixth Vice-President, elected Fifth Vice-President.

Richmond, Fredericksburg & Potomac.

May—W. J. Leake elected President, succeeding E. T. D. Myers, deceased.

San Antonio & Aransas Pass.

June—C. R. Hudson, President, resigned. (See Mexican Central.)

San Pedro, Los Angeles & Salt Lake.

March—R. C. Kerens, First Vice-President, resigned.

—W. H. Bancroft, Vice-President and General Manager of the Oregon Short Line, elected also First Vice-President of the S. P., L. A. & S. L.

Southern.

March—C. H. Ackert, General Manager, elected Fourth Vice-President.

—T. C. Powell, Freight Traffic Manager, elected Fifth Vice-President.

—H. B. Spencer, General Manager of the St. Louis-Louisville lines, appointed General Manager.

Southern Pacific.

February—E. E. Calvin, Vice-President and General Manager of the Oregon Railroad & Navigation, elected Vice-President and General Manager.

Tidewater.

May—R. Du Puy, Vice-President and General Manager of the St. Joseph & Grand Island, appointed General Manager.

Toledo, St. Louis & Western.

March—G. H. Ross, General Traffic Manager, elected Second Vice-President.

Union Pacific.

April—A. L. Mohler, General Manager of the Lines East of Green River, elected Vice-President.

Wabash.

April—F. A. Delano, late General Manager of the Burlington lines east of the Missouri river, elected First Vice-President.

—Henry Miller, General Superintendent of the Chicago, Burlington & Quincy, appointed General Manager.

October—F. A. Delano, First Vice-President, elected President, succeeding Joseph Ramsey, Jr.

—A. C. Bird, Vice-President, resigned.

—E. B. Pryor, Assistant to the President, elected Fourth Vice-President.

Wabash-Pittsburg Terminal and *Wheeling & Lake Erie.*

April—Joseph Ramsey, Jr., President, resigned.

—F. A. Delano elected President.

May—B. A. Worthington, Vice-President and General Manager of the O. R. R. & N., elected Vice-President, succeeding J. W. Patterson, resigned.

September—R. Blickensderfer, General Manager, resigned.

October—B. A. Worthington, Vice-President, also appointed General Manager.

Western Maryland.—

November—A. Robertson, General Manager of the Terminal Railroad Association of St. Louis, appointed General Manager of the W. M. and the West Virginia Central & Pittsburg.

Western Pacific.

June—W. J. Barnett, President, resigned.

—E. T. Jeffery, President of the Denver & Rio Grande, elected also President of the Western Pacific.

—W. J. Barnett, J. White and V. G. Bogue elected Vice-Presidents.

Washington Correspondence.

Washington, Dec. 26.—When Congress reassembles next week it is expected that there will be important developments in both houses in connection with proposed railroad legislation. Representative Hepburn, Chairman of the House Committee on Interstate and Foreign Commerce, is at work on a bill which will probably be introduced soon after the recess and will be made the basis of the measure that is to be reported from his committee. Mr. Hepburn has had little to say about his bill, but it is expected that it will follow the recommendation of the President as to giving the Interstate Commerce Commission authority to prescribe maximum rates. There is some curiosity to know just what provisions for judicial review Mr. Hepburn will incorporate in his bill, for he has always held that there should be opportunity for review prior to a rate fixed by the Commission being put into effect. His bill of the last session provided for such judicial review, and it was with great reluctance that he agreed to the Esch-Townsend bill. He did so and reported that bill to the House only when it became apparent that he would be outvoted in the committee if he insisted on forcing a vote on his own bill. It is probable that the bill he will introduce will provide for the rate fixed by the Commission going into effect prior to review, as, in view of the President's position on that point, it is not probable that a bill providing for prior review can be reported from the House Committee.

When the Senate Committee meets again efforts will be made to expedite an agreement on a report to the Senate. The fact that the resolution under which the Senate Committee sat during the recess provided that it should report to the Senate within 10 days after the beginning of the session has been generally lost sight of. More than 10 days had expired before the beginning of the

recess, but the committee had made no serious effort to agree upon a report. It would have been impossible for the committee to have agreed within the time fixed by the resolution, for there are scarcely two members of the committee who would agree upon all the details of a bill. There are so many differences of opinion that it will doubtless take several weeks and a series of compromises to secure the support of a majority of the committee for any bill, and when a majority report has been agreed upon it is probable that there will be at least two minority reports.

One of the difficulties in the way of an early report from the Senate Committee will be encountered in the effort that the Republican members of the committee will make to secure enough votes on their own side of the committee to report a bill. It is apparent that it will be very difficult, for instance, for Senator Foraker and Senator Dolliver to find any common ground on which both can stand. It is possible that, rather than form a combination with the Democratic members of the committee, the Republican advocates of giving the Commission authority to fix rates may ultimately unite on the Elkins proposition, but Senator Foraker and possibly one or two others may be expected to stand out against this compromise as long as there is any hope of defeating it without hopelessly dividing the party. It is even possible that Senator Foraker might go so far as to stand out against all of the other Republican members of the committee, for he believes that the proposition to give this power to the Commission is nothing short of revolutionary.

No positive predictions as to how the Democratic members of the committee will vote can yet be made. Senator McLaurin, of Mississippi, for instance, is reluctant to give the executive department of the government the power over transportation and commerce proposed by the advocates of commission-made rates, but there are one or two rate situations in Mississippi that seem to him to involve undue discriminations against certain localities, and he is disposed to give to the Commission the power to fix rates if he can be satisfied that it would lead to the correction of what he believes to be discrimination against non-competitive points. Senator Foster, of Louisiana, is another uncertain quantity on the Democratic side. Many of the business men of New Orleans are of the opinion that their city could not hope to fare so well under commission made rates as it does with the railroads free to make import and export rates through their port so as to attract trade to it that might go to the Atlantic ports under a system of rate-making by the Commission that would be based largely on considerations of distance, and these men have not hesitated to impress their views on Senator Foster. Senator Carmack, of Tennessee, is generally counted among the advocates of giving the Commission authority to make rates, but he is receiving many protests against this legislation from his home city of Memphis and from other points in Tennessee. Senator Tillman, of South Carolina, has already defined his position by introducing a bill proposing to empower the Commission to make maximum rates. Senator Newlands, of Nevada, the remaining Democrat, has a scheme of his own for the national incorporation of railroads and their management under governmental control, and he may decide not to support any plan advocated by other members of the committee and submit a minority report to the Senate advocating his own bill. Whatever may be the final result, the present outlook is for divisions on both sides of the committee.

Winnipeg Shops of the Canadian Pacific.

Within the last three years the Canadian Pacific has built two large and modern car and locomotive repair shops, the Angus shops at Montreal and the Winnipeg shops at Winnipeg, Manitoba. The Montreal shops take care of the heavy repair work on the eastern divisions and some locomotive and car building is done there. The Winnipeg shops are for repair work only and handle the motive power and rolling stock on the western lines. The shop tract includes about 160 acres and is 2½ miles west of the passenger station on the main line. A complete local fire alarm system connects with the power house and the city fire alarm system. There are about 12 miles of tracks, four miles of water pipes and about two miles of drains in and around the buildings, the egg-shaped main drain being of concrete, 3 ft. 6 in. by 2 ft. 4 in. All the shop buildings are laid out with a view to future extensions without disturbing the existing plant.

The buildings are of native brick on concrete foundations. They are of "mill construction," and are equipped with fire sprinklers throughout. They are heated with the Sturtevant hot blast system, by exhaust steam from the power house. All the shops have outside lean-to buildings for lavatories and fan-houses.

Water for power and shop purposes is pumped from the Red river, about three miles east of the shops, through an 8-in. pipe, into a 500,000-gallon reservoir, and from there into an elevated 125,000-gallon tank, 130 ft. high. Drinking water is pumped from a 5-in. artesian well, near the power house, into an elevated 10,000-gallon tank.

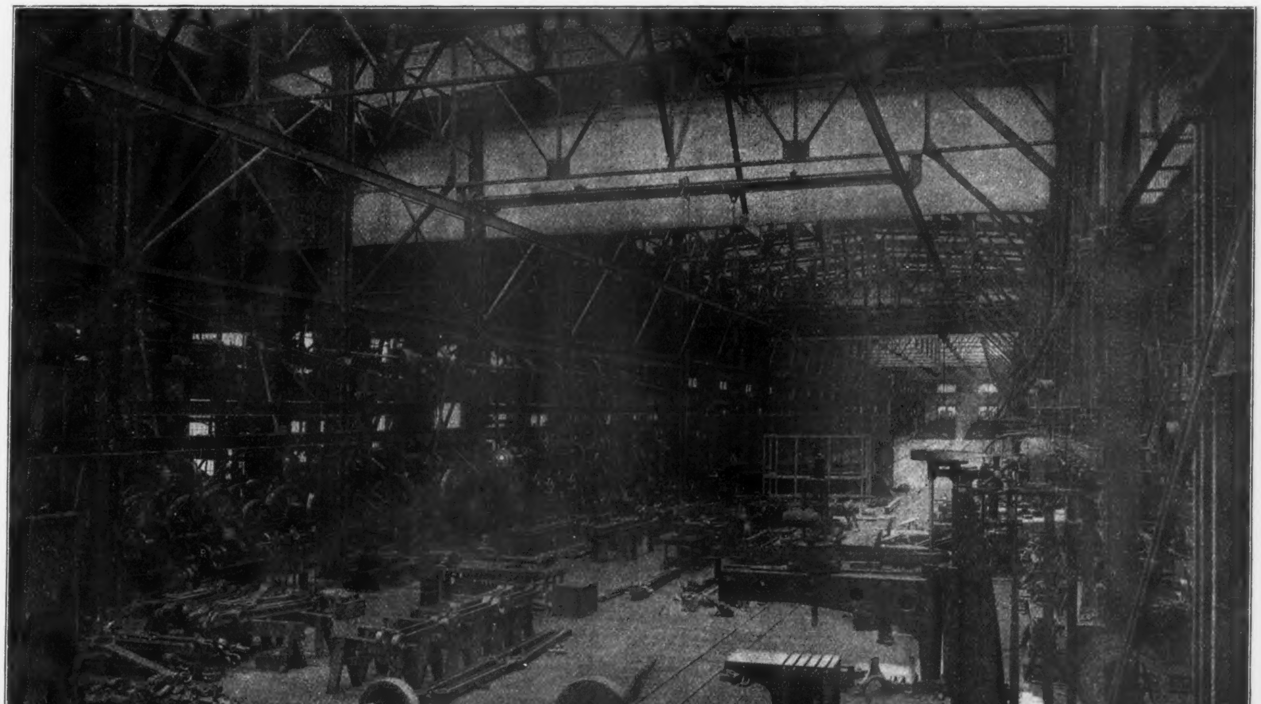
Power House.—The power house is 125 ft. by 101 ft., and is equipped with five 250-h.p. Babcock & Wilcox boilers, two fire pumps, and two pumps for power and shop purposes of a capacity of 1,000 gallons per minute each, two 500-k.w. units driven by simple, non-condensing, open type engines, and a 50-k.w. unit for night service. The exhaust steam from the engines is used for heating the shops, in connection with the Sturtevant system, at 5 lbs. pressure, the condensed water being pumped back to the boiler feed hot well. The engine room has a 15-ton, hand-power, chain sprocket, traveling crane of 46-ft. span and 25-ft. lift.

Locomotive and Machine Shop.—This building is 164 ft. by 792 ft. and has a capacity for making general repairs to 25 locomotives a month. It is completely equipped with modern machinery for general repair work. A rivetting tower at one end has a 20-ton rivetting crane and 5-ton auxiliary hoist. There are two 7½-ton and one 20-ton, three-motor electric traveling cranes, each of 56-ft. span and 27-ft. lift, traveling the whole length of the shop over the middle bay. Two 50-ton trolleys are used for stripping the locomotives. A transfer table 52 ft. wide and 440 ft. long in the center bay of the shop is used for placing locomotives on the pits. A 70-ft. turntable is placed just outside the main shop entrance. Eight longitudinal tracks at the east end are used for light repairs to locomotives, six of the tracks having pits connecting with a drop pit. All machines are motor-driven, the large machines individually, and the small ones with group drive. All the machines are served by narrow gage tracks in conjunction with jib cranes which are provided for all machines handling work requiring heavy lifting. Tender and boiler work is done on the north side of the locomotive shop; the erecting pits are on the south side and across the east end.

Blacksmith Shop.—The blacksmith shop is 216 ft. by 100 ft.

South Side of Machine and Erecting Shop and Store House—Winnipeg Shops of the Canadian Pacific.

Planing Mill and Car Shop—Winnipeg Shops of the Canadian Pacific.



West End of Machine Shop—Winnipeg Shops of the Canadian Pacific.

It has 32 fires and 14 oil furnaces, and is equipped with 11 jib cranes with a capacity of from one to three tons each, one 1,200-lb. single frame hammer, one 700-lb. single frame hammer, one 3,000-lb. double frame hammer, and one 3,300-lb. single frame hammer, and several 150-lb. and 250-lb. automatic hammers. This shop also has cold sawing machines, punches, shears and bull-dozers, all motor driven and served by narrow gage tracks. All forges are fitted with the Sturtevant blast system and a separate system for exhaust.

Foundry.—The foundry is 120 ft. by 90 ft. and has a capacity of 12 tons of castings per day. It is equipped with a three-motor, 7½-ton traveling crane of 38-ft. span and 20-ft. lift; a 5-ton jib crane with a 5-h.p. motor and controller, a 40-in. cupola with a No. 8 Sturtevant pressure blower run by a 30-h.p. A. C. motor, and one two and one five-ton spur geared crane ladles. There are two core ovens, one 9 ft. by 16 ft. and the other 7 ft. 6 in. by 9 ft., and one grinder and two tumblers run by a 10-h.p. motor. The brass foundry is equipped with a one-ton traveling crane, four furnaces, one tumbler and grinder. A two-ton pneumatic elevator, 16-ft. lift, runs from the ground to the charging floor of the cupola. Provision is also made in the foundry for a second cupola which is to be removed from the old shops.

Passenger Car Shop.—This shop is 240 ft. by 100 ft. and has a capacity, for general repairs, of about 25 cars a month. The upholstering work is done on the gallery on the east side of the shop. An outside transfer table 70 ft. wide and 450 ft. long serves this shop and the freight car shop.

Freight Car Shop.—This building is 312 ft. by 100 ft. and has a capacity, for general repairs (including rebuilding) of about 70 cars per month. The repair yards, at the east end of the shops, have a capacity, for light repairs, of 150 cars a day.

Dry Kiln.—This building is a Morton moist air down draft kiln. It has two compartments, each 85 ft. by 19 ft., and has a capacity of four cars of lumber.

Planing Mill.—The mill building is 216 ft. by 100 ft., and is equipped with machinery for manufacturing all material for repairs to freight and passenger cars on the divisions between Fort William and Calgary. All the machines are individually driven by motors. The machines are equipped with a shaving exhaust system, which carries all shavings from each machine to a tower near the power house, and from there direct to the boilers, where they are burned.

General Stores and Offices.—This building is 252 ft. by 85 ft., two stories high. The general offices for the shops are at the west end of the building, and are three stories high. The stores building is fitted with suitable shelving, cupboards and bins sufficient for storing all supplies for the western lines, from Fort William to Vancouver, including branches. It is also provided with a two-ton hydro-pneumatic elevator, and a narrow gage system of tracks connects the building with all shops. A platform 4 ft. high runs all around the building, 10 ft. wide on the north and south sides, 70 ft. wide on the west end, and 200 ft. at the east end for receiving, storing and shipping supplies.

An English Engineer's Opinion on the Panama Canal.

Mr. L. F. Vernon-Harcourt, a well-known English engineer, who has had much professional experience in work on the Mississippi river, has made a statement of his views on the kind of canal which should be built at Panama. This expression of opinion, however, is made subject to more complete information of the circumstances of the case, known as yet only to those acquainted with the findings of the Advisory Board of Engineers.

Mr. Vernon-Harcourt's statement, quoted from the European edition of the *New York Herald*, is as follows:

"It is obvious that a canal with locks as proposed by the Isthmian Canal Commission of 1889-1901, could be completed much sooner and at considerably smaller cost than a sea level canal, on account of the excavation for a lock canal being much less in the deep Culebra cut and also along the whole length of the proposed summit level, and particularly in view of the difficulty of obtaining adequate and efficient labor at the isthmus. In the circumstances, however, that the United States government has undertaken the construction of the canal these considerations are of much less importance than for a private company, in which case early completion and moderate capital expenditure are most essential, provided permanent advantages are secured fairly commensurate with the delay in completion, and the enhanced expenditure in a tide level canal.

"It appears to me, so far as the information at my disposal goes, that the choice between a lock canal and a sea level canal, with a tidal lock at Miraflores, which is essential, depends upon the possibility of constructing a dam at Bohio in a sound foundation, as proposed by the Canal Commission of 1899-1901, so as to obtain lake navigation for a considerable portion of the summit reach of the canal, and to the extent to which the Chagres river might prove a permanent menace to the security of the sea level canal, with the greater speed practicable along Bohio Lake compensating in a great measure for the delay at locks. With more complete security against the incursion of the floods of the Chagres river, a canal with locks would seem preferable to a sea level canal, especially as any future enlargements and deepening for the increased dimensions of vessels would involve much less excavation with a lock canal than with a sea level canal. On the contrary, if the Bohio dam is impracticable at any reasonable cost, owing to the great depth to which the foundation would have to be carried to reach a sufficiently sound stratum, as has been recently stated, and if the floods of the Chagres river cannot be perfectly controlled by a dam at Gamboa at a reasonable cost, then a sea level canal should have the preference on account of the greater facility it would afford for the passage of vessels across the isthmus.

"M. Bunau-Varilla's alternative scheme does not appear to be acceptable, for these reasons: It is quite true that dredging soft soil and transporting soft soil or blasted rock by water is cheaper than excavating soft soil and land transport, and a good deal of the original excavation for the Suez Canal was effected in hollows flooded by water from a fresh water canal, the water being gradually lowered as the dredging proceeded. It remains, however, to be proved that breaking up rock by Lobnitza rock cutting saws is cheaper than ordinary blasting of rock out of water, and it is far more troublesome to complete the enlargement of the waterway after it is opened without impeding traffic than by straightforward dredging for forming a canal, while the modification proposed in the water level of the existing waterway forming such a great highway for shipping would be attended by very great difficulty. A fatal objection, moreover, to the economy and rapidity of execution of M. Bunau-Varilla's scheme is that he could not in future enlarge the upper part of the deep cutting by dredging which would be required for a sea level canal, and if the work is to be done by dredging it would be necessary to carry out the upper part of the cutting to the full width at once. Clearly, to attempt the execution of M. Bunau-Varilla's project is not to be recommended, and the choice lies between a canal with locks, if the Bohio dam is feasible—and there is not any doubt as to preventing with certainty the incursion of the Chagres floods into a low level canal—and a sea level canal with a tidal lock on the Panama site."

Report of New South Wales Delegates.

An elaborate and interesting report has been submitted to the New South Wales Government Railway Commissioners by James Fraser, M. J. C. E., Engineer-in-Chief, and H. McLachlan, Secretary to the Commissioners, regarding their recent visit to the United States as delegates to the Railway Congress. Part of this report is printed herewith.

As regards electric traction, the report says: "On the Baltimore & Ohio lines at Baltimore the motors for hauling passenger trains (with the locomotive dead) weigh 95 tons on four axles, or 23¾ tons per axle, all traction weight, and those for freight work each 80 tons on four axles. Two of these latter can, however, be coupled together and work as one unit, with an adhesive weight of 160 tons. These two motors working coupled lift a load of 2,000 tons gross on a grade of 1½ per cent., or 1 in 66, and are in respect of load hauled the most powerful engines at present existing.

"It is not claimed that the work is done economically; in fact, the reverse is the case, as the General Superintendent of Motive Power of the company informed us that the cost per ton-mile is more than twice as great as with steam power. However, very heavy loads are taken through the center of the city without smoke, and through long tunnels where only small loads would be possible owing to the fumes were steam locomotives used."

After going into some details regarding the New York Central electrification project, the report says: "Apart from the American systems described, which were or are about to be installed on account of exceptional circumstances and not as a means of economical working, the modification of the Liverpool & Southport in England is perhaps the most important, and we might mention as a preface to our remarks on this system, that in conversation with Mr. Aspinall, General Manager of the Lancashire & Yorkshire Company, of whose system the section mentioned forms part, he expressed himself as unfavorable to the modification, stating that working cost was very greatly increased and the only material advantage is the slight addition that can be made to the number of trains worked, and on that account an increase in receipts. During 12 months working it was shown that, while receipts increased, electric operation was more expensive than steam, the principal increase being in coal consumption. The cost of electric installation was £20,000 per mile, equal to about three and a half times the installation of a steam locomotive service. The Liverpool & Southport line is operated by direct current.

"The present adoption by our state of any system of electrical working of railroads does not appear desirable. First cost and operation of direct current through a third rail both being high, and as there is practical certainty of successful operation of the single-phase alternating current, we should, we think, wait the

result of further experiments and experience in older countries in this system before making any movement of our own."

On the rail motor question the New South Wales engineers say: "On the London & Southwestern (England), the latest form of motor car embraces the ordinary type of railroad locomotive boiler and engine on a small scale, and it is contended it gives better results than the vertical form. In regard to the cost of working the figures given struck us as abnormally low, coming down on a month's average (Bishop Waltham branch) to as little as 3 pence per mile (locomotive service), covering driver, cleaner, coal, oil and water; and the Great Western Railway, which has a large number of motors, about 70—rail and road—at work, gives the average cost of working, including interest and depreciation at 7⅓ pence per car mile (rail motors). This figure supports the view that the locomotive type boiler is the more economical. It is claimed by those who have had to operate them that the success of the cars has demonstrated their utility in enabling increased facility for travel and stimulating business. We suggest that they are well worthy of being considered in connection with a number of services on our line. There appears to be a future before the 'rail motor,' and both at the Congress and in England we were impressed with the attention which is being given to the matter and the number of vehicles which are being put into service. In some cases, on branch lines with limited traffic, they are doing the whole of the passenger business, and their low cost of running enables services to be given to the convenience of local residents, which would not be economically possible with the ordinary locomotive. In connection with the Great Western, which had carried 3,000,000 passengers in 18 months, it is claimed that their operation has been profitable—cost 7.35 pence, earnings 9.91 pence per car mile."

Regarding the Mallet articulated locomotive at work on the B. & O. heavy gradients, the report says: "This locomotive lifts in a grade of 1 in 100 a train of a gross weight of 2,200 tons. The following data was obtained by us as to coal consumption: Length of heavy section operated, 14.8 miles; grade 1-100, 6.5 miles; grade 1-200 to 1-500, 8.3 miles; maximum curvature, 9 deg.; average atmospheric temperature, 17 deg.; average feed water temperature, 35 deg.; pounds of coal consumed per square foot of grate used per hour, 66; pounds of coal consumed per mile run, 584; pounds of coal consumed per 1,000 ton-miles, 308.5; average boiler pressure, 218; pounds of water evaporated per pound of coal, 5.4. The engine was operated by one engineer and one fireman on this work, and judging from the results obtained it would seem a desirable type of engine to employ on our heavy gradients, where, on account of tunnel or other causes, an assistant engineer cannot at present be used; in fact, engines of this type might probably be used with advantage on all heavy sections, as the axle-load could be greater than with existing heavy engines, while the division of the engine into two sets of drivers would enable it to take our sharp curves easily, as on the 9 deg. curve the flange wear has been trivial, but that may to some extent be due to the elastic bar frames used."

Continuing the report says: "The permanent-way accessories, switches, crossings, etc., are in many cases bad on American and Canadian roads, as in both stub switches are largely used, but the best American switches and crossings leave little room for improvement. These latter are very similar to what we have used during the past ten years, except that in the case of switches, the 4-ft. rods are stiffer and riveted to the switch instead of passing through the webs, as is done in our state. The American practice is in this respect the better, and they have made larger use of 'spring-frogs' and switches in lieu of crossings than has been done in any other country. We have done something in this respect, but might with advantage follow more extensively American practice. We saw nowhere any improved tools for permanent-way or bridge work, but Fairbanks, Morse & Company had at Washington a good exhibit of motor trolleys, the use of which might, by moving men speedily from place to place, permit of some reduction of the maintenance gangs on some sections of our system.

"Of machines for ways and works we saw some, the introduction of which should prove of advantage, and of new machines special mention might be made of the high-speed sensitive drills exhibited by Hill, Clarke & Company, at Washington, one of which we purchased while in America. These machines run at practically the same speed as wood tools; and we have since learned that many machines of a similar type are in use in Germany, where punched and reamed work in bridge construction has been abandoned for all drilled, and high-speed machines doing the work in less time than when two operations were made. These machines should be serviceable for much of the work done in our permanent-way shops. Of air tools there were very good exhibits at Washington, but that placed by the Rand Drill Company was distinctly the best. No special improvement has been made in pneumatic drills or hammers, but two good types of hoists were shown—one by the Rand Drill & Pneumatic Tool Company and the other by the General Electric Company. The former a pneumatic machine, with a small cylinder and spiral barrel to carry an endless wire rope, similar in design to a small steam hoist, was compact, and a more serviceable machine in many ways than the straight air hoists which we have now in use. The latter are very similar, made by the Sprague Company, and are worked electrically.

"Of tools for the manufacture of switches and crossings we saw nothing novel except those in use in planing machines in the Ramapo Iron Works at Niagara Falls. The planing machines carry double tool boxes, but the tools themselves, made from self-hardening steel, have broad, chisel-shaped cutting edges, and the top, bottom and sides are taken off practically to full depth or width. This form of tool will be adopted with much advantage in our own shops, as the work can be done much more speedily and cheaply.

"Of bridge shops we inspected only one, viz., that operated by the King Bridge Company at Cleveland. The material is delivered in a yard at one end of the shop, carried forward into covered shops by means of pneumatic hoists; and all work in the shops is done by means of air tools, to which material is delivered by straight air-hoists on single-joint runways. At this establishment, too, we saw some very large turntables being made. For roundhouses in America it is now usual to erect turntables 80 ft. to 100 ft. in diameter, and it is essential that these should run lightly. An improvement in the old type cone-bearings has been made by the King Bridge Company. The cones are about 9 in. in length and travel on the ordinary beveled path, but are provided with pintles (at both ends), which are run in ball-bearings. These centers run with an absolute minimum friction, and should we require to erect heavier turntables than are now in use, this bearing is what we should adopt.

"Of systems for locomotive coal-handling, we, unfortunately, saw few, but that of the Pennsylvania Railroad Company at Altoona was the best. In connection with locomotive coal handling, we might mention that the Brown Hoist Machinery Company and the Wellman-Seaver-Morgan Company, of Cleveland, are making clam-shell dredges for coal and ore handling, and that such a device would be of service at our larger locomotive depots for handling coal which for convenient storage is stacked on the ground."

Referring to American coal shipping methods, the report says in part: "At Baltimore the simplest of all systems is adopted, viz., to run the wagons on an elevated stage over bins which are of sufficient height above wharf level to permit of their complete discharge in vessels lying alongside. In this case, too, the feeder tracks, etc., are excellently arranged, each car, after being tipped, passing by gravity to an inside falling track which leads to the reception sidings for empties."

Commenting on American methods for handling freight and passenger traffic Messrs. McLachlan and Fraser state in part: "The country generally is more favorable to big hauls than is the case with us, and it has enabled the American companies to quote lower rates for freight than (with perhaps the exception of India) any railroad company or administration anywhere. It would appear that our practice in regard to capacity of cars, having in view our local conditions, was more satisfactory for our requirements, although with our extensive stock traffic it would seem to be wise to follow the American practice and to adopt more extensively bogie trucks with large capacity for live stock. In connection with traffic manipulation, we think it desirable to refer to the later systems of marshalling freight by gravity. Of these systems we saw two, both excellent. First, we visited that of the Pennsylvania Railroad Company at Juniata, near Altoona, where for inbound and outbound traffic siding accommodation, 20 tracks for each give a total capacity of over 3,000 50-ton cars. The system involves the construction of a hump approached on an easy grade, so that a heavy train may easily be propelled to the summit. The second system we visited was at the Lake Shore, Michigan & Southern Railroad at Collingwood, near Cleveland. Here the switches are operated by hand instead of power, as is the case at Altoona. At Collingwood we saw a train of 60 cars broken up into 24 sections and delivered and at rest in their proper sidings in eight minutes."

Another A. C. Interurban Line.

Announcement is made that the Toledo & Chicago Interurban Railway, which will extend, when completed, from Goshen, Ind., to Alvordton, Ohio, with a branch south to Fort Wayne, will be equipped with the General Electric Company's single phase alternating current system. At present 50 miles of the road, constituting the branch from the proposed east and west main line to Fort Wayne, Ind., is completed and about ready to start operation. The company owns private right-of-way alongside the highways, and has franchises which permit it to run cars on the main streets of the cities and towns traversed. It expects to carry express and freight, as well as passengers.

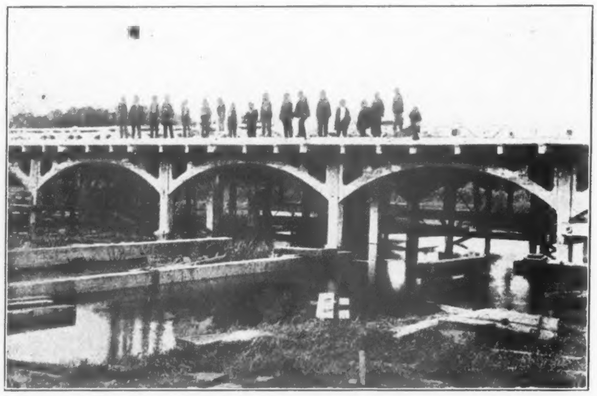
It will be recollected that the first regular single phase line in this country of any considerable length was opened just about a year ago—the Indianapolis-Rushville section, 40 miles long, of the

Indianapolis & Cincinnati Traction Company. This road was built under the direction of Sargent & Lundy, consulting engineers, and equipped by the Westinghouse Electric & Manufacturing Company. The Toledo & Chicago company is now preparing to put 50 miles in operation, as stated above, so that it will have the longest single phase line at present in existence in this country. F. E. Seagrave, Toledo, is President, and F. B. Perkins is General Manager and Electrical Engineer.

Tramway Bridge of Reinforced Concrete.

BY W. B. PALEY.

The corporation of Bournemouth, England, recently extended its system of tramways to the town of Christchurch. The extension, some 3½ miles long, a single track line of 3 ft. 6 in. gage, includes an interesting specimen of reinforced concrete construction in a bridge over the river Stour. It has been erected by the Yorkshire Hennebique Contracting Company, of Leeds, in the short space of four months. As the river is tidal a pre-existing bridge had to be removed, one side of it being kept up to maintain the communication till the new work was ready, the difficulty of the undertaking was considerable. There are 48 piers, each containing four round steel rods, which are carried over in the arches, of which there are four in each span. These arches are of 25 ft. 6 in. span, except one over the deepest part of the stream, which is 41 ft. There is also a half-arch at each side, making 14 openings in all, of a total length of 347 ft. A footpath on each side, 6 ft. wide, is supported on corbels of concrete, reinforced with steel rods. The actual width of the bridge proper is 17 ft. 6 in., not reckoning the footpaths. It carries a double line of electric tramway, worked on the usual overhead or



A Tramway Bridge of Reinforced Concrete.

trolley system. Trials were made on October 14, a few days before the opening for traffic, with three 12-ton tram-cars, each loaded up to 16 tons. Bags of cement were also piled on the bridge, to the extent of 210 lbs. per square foot, to represent additional traffic. The cars were run together over each line, in both directions, two being made finally to pass each other at full speed on the 41 ft. span, with the result that a deflection of only ⅛ in. was shown by the "amplificator." The rigidity of the bridge, as observed from a car, is certainly most noticeable, quite equal to anything that could be attained by a brick or stone structure, whilst both the cost and the length of time occupied in erection have been less. Time was of importance, besides the ordinary reasons, as a few days rain causes the river to overflow the low-lying land on the Christchurch side, where it was necessary to prepare part of the materials. A short wooden stage was built on each bank, carrying a traveling crane with a jib long enough to reach the center of the bridge. By these cranes, of course, the concrete, ready for use, was swung out in large buckets wherever it was wanted.

The photograph shows the work whilst half of the old bridge was still in use, its light iron piers being plainly visible, as well as the temporary hand railing of wood separating it from the new work. Iron hand-rails have, of course, now been added on each side. The amount of the contract is understood to have been about £4,000, with £500 additional for the abutments. The bridge, the general effect of which is very good, is the largest construction in this material yet erected in the south of England; in fact, very few works of any magnitude have so far been attempted in this country in reinforced concrete.

Exact measurements of the Simplon tunnel made recently show the variations from the calculated measurements. The actual length of the tunnel is 31 in. less than was found from the trigonometrical survey before it was built. The axis of the tunnel from the north portal deviated to the east; that from the south portal to the west, so that in the middle of the tunnel they were 8 in. apart horizontally and 3½ in. vertically. These variations, be it remembered, are in a tunnel 12 miles, 1,452 ft. 4 in. long, and a fraction over.

Care, Use and Design of Locomotive Boilers.

At the November meeting of the Pacific Railroad Club at San Francisco papers were presented by Geo. Austin and J. J. Malone on the care, use and design of locomotive boilers. The location of the club apparently had something to do with the character of the presentation, for the value of blowing off and the reasons for the practice were brought prominently to the front. Blowing off is used as a means of reducing the accumulation of sludge and of lowering the concentration of foaming matter. The first requires that boilers be blown out at frequent intervals with small quantities at each blowing. On divisions where the water contains considerable impurities, not necessarily foaming matter, blow-off cocks should be located at the lower parts, such as the front and back legs of firebox, and should only be operated when steam is not being used, a few moments after the throttle has been closed; this allows the sediment to settle.

For this it is not necessary that large quantities of water be blown out, since it will run clear after the first few seconds. The largest deposits of sludge will be found at the mud ring, where they will be found to vary from 1 to 9 in. in front, and from 3 in. to 18 in. at the back. The heaviest deposits are always found in the water space on the mud-ring between the door sheet and back head. The reason for this is clear when the circulation of the water is considered from the boiler checks to its final ascension, since it moves from the checks towards the back part of the boiler, and the sediment is slowly carried to that point and deposited.

Blowing out to prevent foaming is an entirely different proposition, for the reason that the water in a boiler that is charged with alkali is charged about equally throughout the boiler; consequently, blowing out from any part of the boiler at any time, either while working steam or not, is good practice to anticipate and prevent foaming.

It must not be thought, however, that foaming will cease the moment the blow-off cock is opened. Blowing off does not decrease the amount of concentration; it merely lessens the amount of water, so that by adding more the concentration may be lowered, and when this has been done, not before, the foaming will cease. In alkali districts a concentration of about 200 grains to the gallon will be needed before foaming will really begin. But this will be preceded by a sort of surface foaming. That is to say, the engine will work wet steam for a considerable length of time previous to showing by the water filling up the glass that the boiler is priming or foaming. This working wet steam condition probably precedes the actual foaming condition by several miles; and suggests about the proper time when the blow-off cocks should be liberally used and the concentration as to the foaming matter per gallon be reduced in the boiler by refilling with clean water.

The excuse that is sometimes made, that the blow-off cock is not opened for fear of losing water, is not a valid one, because the practice will actually effect a saving. Working wet steam previous to actual foaming, and working water while foaming will use up a far greater quantity than if the blow-off cock has been used and water kept below the foaming point, entirely apart from consideration of the saving to the machinery.

There is one other reason for the failure of the engineman to use his blow-off cocks, and that is the inconvenient places in which they are frequently located. It is sometimes even necessary for the enginemen to crawl out on the running board in order to use them, and when this is the case, or when other similar inconveniences exist, they are sure to be neglected.

Further, care should be taken in blowing out boilers not to have the injectors working at the same time the blow-off cock is open. It is a much better plan to fill up the boilers and then blow them down. The ideal way to handle the feed water in locomotive boilers, especially in alkali districts, is to always put in the boiler a little more water than is being used, and blow the surplus water out; this preserves the boiler in fair condition for a longer period to do business without foaming, and it reduces the necessity of blowing out large quantities of water frequently, besides preventing the unequal temperatures caused by blowing out large quantities and refilling.

The best time to blow-off will be found to be before foaming commences, when the concentration is about 175 grains to the gallon. This will prevent foaming. Don't wait until foaming begins, or an engine failure will result, for then it will be impossible for the engine to work until the water has been purified. That takes time, and lost time is engine failure. In the cooling of the boiler the utmost care should be exercised. There are three methods in use, that may be described as follows:

First.—Open the blow-off cock, blow out all water and steam

at the same time, and then fill up with cold water to cool.

Second.—Set the engine in the house with water-glass full. Close all ash-pan openings and door. Cover the smokestack and allow the boiler to cool down until the water in the boiler is at a temperature of 70 or 80 deg.

Third.—Where practicable, place engine in roundhouse with fire in, and leave fire, where coal is used, until it dies out. Where oil is used, cut the feed of oil down for a half hour before shutting down entirely. Let the boiler cool down gradually, closing all dampers, until water in the boiler is at a temperature of 70 or 80 deg.

The first method is the worst that possibly could be used. If one were hunting for a method that would do the most damage, it would be hard to improve on this one. When one considers that some things similar to this method are quite the regular practice, is it any wonder that 50 per cent. of the engine delays and failures are from boiler troubles? The second and third methods cannot be followed in practice at all times. What is advocated is that they be adhered to as closely as possible and that the first be avoided.

When a boiler needs washing, it should be cooled carefully and washed thoroughly. Every wash-out plug in the boiler should come out. It is very bad practice to wash the belly of the boiler one time, the crown-sheet another time, and so on. Cooling a boiler is a serious matter, and when it is cool the washing should be thorough. It will run enough longer the next time to pay for it. Careful cooling means giving a boiler all the chance possible to cool. If time will not permit cooling the boiler as mentioned above, it is suggested that at least one and a half hours be spent in working the steam down uniformly to no pressure. It should never be blown out through the relief valve holes in 10 or 12 minutes. In all cases of reducing steam, water should be above the crown-sheet at all times.

If the firebox has an arch or fire-brick work, water should not be drawn below crown-sheet in less than three or four hours after the fire is removed. This includes the time used in reducing the steam and cooling. When the boiler is cool, remove all mud-ring plugs, and let out water. The crown-sheet can be washed as soon as the water leaves it. The belly plugs in the bottom of the barrel of the boiler should not be removed until all the water is out of the mud-ring. By removing them after this, one can tell if there is a bank in the belly of the boiler. If there is, water will run from these holes after plugs are removed. The belly should be well washed, and lastly the mud-ring. The following are places to wash carefully for mud and scale banking: Over fire-doors, on belly and flue-sheet braces, just above front mud ring, and from there forward about one-third the length of the barrel; also on the crown-sheets of engines having crown-bars. Boiler washers should inspect boilers with a torch, through plug-holes, to see if they are clean, and also to familiarize themselves with the internal construction, so that they can wash to better advantage. In washing through all plug-holes, the nozzle should be turned so as to wash down all sediment that may have collected between tubes, braces and staybolts. Wash-out plugs should always have mixed oil and graphite put on them before screwing in. Then screw in with the fingers as far as they will go, and they should go within a very few turns of being tight. This practice will insure not getting the threads crossed. They should not be screwed in with a long wrench and as hard as a man can pull. A 16-in. wrench, used with one hand, makes them tight enough. The plug will last longer, will not leak, and will come out so much easier the next time. A shoulder is put on many plugs by being pulled in too tight. Then time is lost in getting them out. About every two months, in bad-water districts, boilers with radial stays in crown-sheet should have dome-cap taken off and stand-pipe taken out of dome, in order that a man may get in and scale the crown-sheet, stay-bolts and radial stays, then wash the crown-sheet and side-sheets on the inside of the boiler. Be careful and wash as long as anything can be removed.

Good boiler washing requires at least 100 lbs. pressure. The practice of using hot water for washing boilers cuts but very little figure; it is destructive to hose, and presents no feature that would make it enough desirable over the cold water system to warrant its adoption. This, of course, applies to points where water is plentiful; where water is scarce, it would pay to conserve it and use it over again for washing out purposes.

The method of handling feed-water by enginemen is a very large factor in causing firebox leaks. It has been thoroughly demonstrated within the last six years that these variations and inequalities in temperature play a most prominent part, not only in causing leaks, but also in causing damage and actual destruction to certain parts of locomotive boilers. Actual tests have demonstrated the fact that a piece of iron or steel can be heated or cooled any number of times without decreasing its strength. Therefore, the simple heating and cooling of a boiler will not cause the metal in it to deteriorate or become weaker, if it is always cooled and heated uniformly.

A boiler being made up of many pieces of iron securely riveted together, it would follow that to cool any one portion and not to cool the rest would mean that incalculable strains would be put on the boiler seams and plates. The strains (that is, the steam pressure) that boilers are built to stand are small, indeed, as compared with the strains put on them on account of inequalities of temperature. And these are the agencies that really disturb the joints and cause leaks.

The value of feed water purification is shown by a comparison of the results obtained on two divisions of the Atchison, Topeka & Santa Fe. One of them, the Eastern Grand division, has 34 treating plants in operation; the other, the New Mexico division, has none. On the Eastern Grand division, with 450 engines in service, during the month of June last there were but 11 failures on account of flue leaks, while on the New Mexico division for the same month there were 73 failures from flue leaks. In the first case, with 11 failures, the mileage per failure on account of leaky flues was 113,500, and the other, with the 73 failures, the mileage per failure was 4,200 miles. There were not as many failures on account of foaming on the water-treated division as there were on the untreated division.

It is not contended that water treating reduces the number of washouts, but the condition is that, with the water treating, washing out is done to remove sludge, which is a very simple process, while with the untreated water washing out is done to get rid of scale, which is frequently an impossible proposition, as the scale adheres tightly, and it is an impossibility to get sufficient water pressure to remove it.

It seems certain that the admission of cold air into the firebox, or large quantities of cold water going into the boilers through the injectors when the boiler is hot, are what we may call adverse or secondary causes of firebox leaks. It is undoubtedly true that the primary cause is overheating. This is caused by the accumulation of scale or waters heavily charged with sediment, which is frequently the case. How heavily charged, cannot be stated. It probably is not an exaggerated statement to say that, in some cases, it ranges from water at the top with a little sediment in it to sediment at the bottom with a little water in it.

The scale forms in the angles where the stays or flues penetrate the sheets, and gradually extends, until sometimes it reaches from one bolt to the other, completely covering the sheet, but being heaviest at the stay-bolt, and stays there until the overheating occurs and the leak begins. This formation will start on flues in some cases, especially in seasons of muddy weather, in a hundred miles service, probably less than that, and in those seasons it does not get hard, but is a putty-like substance, really more difficult to dislodge than a harder scale. The formation of hard scale is one of the reasons why the sectional expander gives better service as a tool for running repairs on flues than the roller expander. The sectional expander jars away this scale and removes the cause, and does it without thinning the flue or making the hole taper.

Leaky flues can be considered along with the subject of corrugated and cracked fire-sheets, as the same causes that govern one govern the other. At a master mechanics' meeting held about two years ago the reported life of tubes ranged from 30,000 miles in Texas to more than 200,000 miles in Wisconsin, and all agreed that cold air was a very bad thing for flues and one of the principal causes of flue leaks. A prominent writer on boiler troubles tells us that it is cold water that is a paramount cause of flue leaks, as it is of corrugated and cracked fire-sheets. It would seem reasonable that if cold water and cold air are so very injurious, that flues should give better service in Texas than they do in Wisconsin, because of the relative climatic conditions in the two localities.

The fact is, these conditions are, as previously stated, secondary, and we must look for the trouble in some other direction. There can be no leaking in ordinary boiler work unless overheating takes place. The assertion is made with the understanding that allowance is made for the natural wear of material, and also for the unequal strains produced by unequal temperatures. These certainly do develop leaks, but the frequency of leaks due to this cause are so few that they are scarcely worthy of being taken into consideration alongside of the actual cause of leaks.

In the design of boilers it is no longer a question of the efficiency or strength of a boiler to care for 200 or 225 lbs. pressure to the square inch. All modern locomotive boiler builders meet this requirement. Whenever feed-water is such that the life of a firebox runs along from 12 to 15 years, it makes but very little difference what the construction of the boiler is, that is to say, whether it is of the wide or narrow firebox type. Since fireboxes will last for 12 or 15 years, it is proof positive that they are not cooling down the boiler and bringing it from one extreme to the other.

With good water, such as may be expected where a boiler lasts 12 or 15 years, it may be desirable and economical to have a wide firebox, as there is no question that wide fireboxes will burn certain kinds of coal with greater economy than narrow fireboxes do.

That being the case, about the only thing to consider for a locality that has good water is a strong and well-supported crown, no matter whether the boiler is of the wide or narrow type. In bad-water districts the conditions are different; consequently, to recommend a certain type of boiler, you must know the locality, and water supply procurable in that locality. Where bad water is the rule, the smaller the stayed surfaces, the less it will cost to maintain the boiler.

It is recommended that a water space commencing with 6 in. at the mud ring, and tapering up to a crown-sheet to a distance of 10 in. from side-sheets, be used. This not only improves the circulation but gives a greater length of stay-bolt to care for the continuous movement of contraction and expansion. It is best also to have the crown-sheets in one continuous sheet for both the inside and outside.

On the Southern Pacific the water is such that flexible bolts cannot be used satisfactorily on crown-sheets, and for top rows on side-sheets, back-heads, and throat-heads, as the water forms a scale in such short time that these bolts would not do the work they were intended for. The reason for flat crown-sheets inside and out is that when the boiler is first fired up and cooled down the outside crown-sheet will expand simultaneously with the inside.

The semi-circular outside crown-sheet on a firebox with radial stays did not meet with the approval of Mr. Malone because when the boiler is first fired up, the outside sheet being cool, and in the form of a semi-circle, there is no give to it until steam is raised on the boiler. This is a hard strain on the threads of the sheets and bolts. The boilers in bad-water districts have to be cooled off and washed out at each end of the division, so that it makes a hard strain on these bolts, both in firing up and cooling down, as it has to be done so often. Of course, this style of box, once the steam is raised, is all right. On boilers which are only washed out or the fire drawn out of firebox every two or three months, as they are on some roads, it does not make so much difference about using this type of box and stay.

The author also objected to the use of tees on the inside of the outside crown-sheet, and the use of tee iron for crown-bars, as it leaves no room for proper bracing of the boiler and cleaning of the crown-sheet; as when the boiler is first put into service, the thimble itself around crown-bolt acts as the same thickness of scale to begin with. Where water is so bad that the scale forms around the outside of the thimble, it will be only a short time before these bolts will leak, requiring a removal of the same and application of new bolts.

As these boilers have so little room between the top and bottom tee irons, and have eight sling braces on each bar, it would be a very expensive job to renew bolts as often as they are required, and replace them in the way they are now; that is, the bolt being screwed in the crown-sheet and not on the top of tee crown-bar; if the bolt is applied this way it is necessary to take out the sling stays on the crown-sheet to get in to put the nut on. It is not generally done in that way: They drill the bolts out of crown-sheet and back it up and tap a hole through crown-bar and crown-sheet, and screw up the stay-bolt. This saves taking off the dome-cap and taking out the stand-pipe to get into the boiler to remove sling-stays to put nuts on. There is no necessity of using a thimble when bolt is replaced in this way, as the threads on the sheet holds it the same distance from crown-bar; this is the general way in which these boilers are repaired, but this is not the way that bolts are applied when first built, as they screw in the sheet and use a thimble and nut on top of crown-bar.

The Trinity River Plant of the North Mountain Power Company.

Among the power transmission systems of the Pacific Coast, one of the most interesting is that of the Trinity river plant of the North Mountain Power Company. This plant is located in the central part of Trinity County, California, two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity river. The nearest railroad point is Redding, on the "Shasta Route" of the Southern Pacific. Humboldt Bay, on the Pacific Ocean, with Eureka, the chief coast city of northern California, lies almost due west, distant 59 miles in a straight line. The altitude of the plant is about 1,480 ft. All material, cement and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits. It required 18 to 20 horses to pull each of the larger pieces, weighing 18,000 lbs., up the grades, and when mud was encountered it was necessary to hitch the 18 horses to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 sq. miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up to an altitude of from 9,000 to 10,000 ft. above sea level. The dam is small, and serves merely for diverting the water. It is of the usual rock-filled crib form. Part of the ditch is cut in solid rock, but the most of it is dug in the side-hill soil. The flumes are 19 in number and vary in length from 30 ft. to 1,200 ft. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is about 9.73 ft. per mile. The penstocks are each 1,165 ft. long. Under a total head of 604 ft. there is an effective head of 600 ft., or a working pressure of 260 lbs. per sq. in.

An 18-Horse Team Hauling the Lower Half of the Stator of a 750 k.w. Bullock Alternator Over 60 Miles of Mountain Road from the Nearest Railroad Station, to the Plant of the North Mountain Power Company.

The plant proper consists of the power house, two transformer houses and three high-tension switch houses. Each of the two hydraulic units consists of a pair of 44-in. Pelton wheels under one sheet steel housing, provided with ring-oiling, self-aligning bearings, coupled to the generator through flexible leather link couplings. The nozzles are of the deflecting type. With the largest tips in service the wheels are capable of driving the generators at 25 per cent. overload.

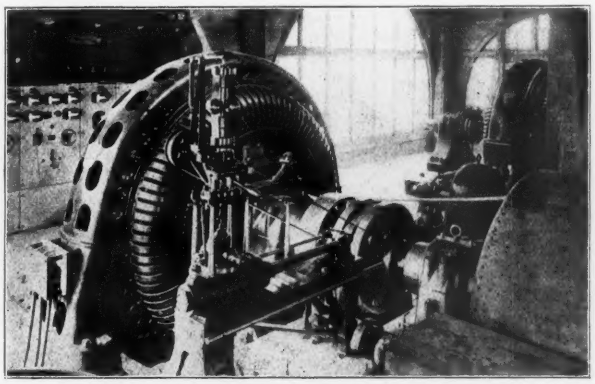
The wheels are controlled by Type "F" Lombard governors using oil. The pressure and vacuum are maintained by oil pumps belt-driven from the wheel shafts. The governors are not fitted with any form of switchboard speed control, but a single operator has no difficulty in synchronizing a generator under the load conditions which exist in the plant. The tail race is 6½ ft. wide and excavated for 280 ft. through bed rock to the Trinity river. The generators, two in number, are of the Bullock type, furnished by Allis-Chalmers Company, of Milwaukee, being three-phase, 750 k.w., 500 r.p.m., 2,200 volts, 25 cycles, rev. field, six-pole. Two Bullock exciters, 125 volts, 45 k.w., 900 r.p.m., are driven by belts from the generators. The switchboards are of marble and have Wagner instruments. The power house, 36 x 51 ft., is built of concrete made up with sand and gravel, taken from the river bars a few rods from the site of the plant, and with imported Portland cement. A special bay or alcove has been provided to give ample space behind the switchboard. The roof is of corrugated iron supported on steel trusses. A "Cyclops" hand-operated crane spans the main part of the building and is fitted with a one-ton "Triplex" block. This easily handles the heaviest piece of machinery.

The leads between the generators, exciters and switchboard are lead-covered cables laid in conduits within the concrete and cement

floor. The transformer house is 13 ft. x 51 ft. 6 in., and is also of concrete. It contains seven step-up transformers., viz., two banks of three each and one in reserve. They are of Bullock make, 300 k.v.a. water cooled, oil insulated, 2,200/19,050 volts, 25 cycle.

The high-tension switch house is a frame structure covered with corrugated iron. In it are two banks of "M-T" single throw air-brake switches, and G.E. alternating current multiplex lightning arresters, connected up for the three-phase circuit. The pole line extends almost due west from the plant to the sub-station in Eureka. The length is 65 miles. Of this 55 miles are over a severely rugged mountainous country; the altitude of the plant is only 1,480 ft. and Eureka is at sea-level, but the line passes over several summits ranging from 4,500 to 5,500 ft. in altitude. Fifty miles of its length lie in a heavily timbered country, requiring a tremendous amount of clearing, the trees ranging from 2 ft. to 4 ft. in diameter. It was necessary to construct a trail nearly the entire length of the line. The route deviates from a straight line only slightly and only where the topography made it unavoidable. It is a "thorough" transmission, so to speak, there being no taps on the line anywhere between the plant and the sub-station at Eureka. The line is a single circuit, three-phase, averaging 35 poles to the mile. The spread of wires on the standard length spans is 40 in.; the wire is No. 4 copper, except on some long spans where stranded cable is used. The potential at present used on line is 30,000 volts.

The sub-station at Eureka includes an auxiliary steam plant consisting of two Babcock & Wilcox water tube boilers fitted with Peabody patent oil burning furnaces duplicate oil pumping system; Goudert auxiliary feed water heater; Wheeler "Admiralty" surface condenser with self-contained steam-driven air and circulating pumps, the cooling water being taken from Humboldt Bay, and a McIntosh and Seymour tandem compound engine of nominal rating of 700 h.p. A jackshaft running at 500 r.p.m. is connected to engine by a rope-drive.



View in Power House, Showing 750 k.w. Bullock Alternator and Lombard Waterwheel Governor.

A Bullock rotary converter, 500 k.w., 500 r.p.m., six-pole, 25-cycle, 550-volt, is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This permits of carrying the load by steam when necessary to shut down the transmission line for repairs. The engine is fitted with a switchboard speed control device. The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity river plant. For the rotary converter there are three Bullock transformers, 190 k.w. water-cooled, 25-cycle, 30,000/352 volts. For stepping down for the local distributing system are three General Electric Company's 400 k.w. water-cooled transformers.

For furnishing power to the 60-cycle incandescent and arc lighting circuits of the city of Eureka, a three-phase, 60-cycle generator is driven by the rotary acting as a synchronous motor. The sub-station is fitted with switchboards and H. T. switches suitable for handling the equipment. A fuel oil tank 54 ft. in diameter by 25 ft. deep, holding 10,000 barrels, has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe-line.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed.

Foreign Railroad Notes.

Last October a Prussian freight engine changed enginemen as usual at a water-tank near the Russian border. The new engineman, instead of backing to the yard where his cars stood and in spite of signals against him, drove his engine directly down the main track and head on into a passenger train. It turned out that the engineman was drunk. As he was killed proceedings could not be taken against him; but it having been learned that the fireman knew he was drunk, the state's attorney has prosecuted him for not reporting the engineman's condition, which the regulations require him to do; and the railroad authorities have improved the occasion to issue orders intended to make more certain the early removal of trainmen who fall into drinking habits.

The management of the Prussian State Railroads has prepared to let contracts thus early for locomotives to be delivered in the next fiscal year, which begins with April. At this time specifications have been made for 427, of different kinds, and of these no less than 162 are to use superheated steam, while 97 are to be compound engines.

The private railroads in Russia in 1903, the complete figures for which have only recently been reported, had a very favorable season, their gross earnings being then 11 per cent. greater than in 1902, while their expenses were 3 per cent. less, resulting in an increase of no less than 21 per cent. in their net earnings. The government had to pay on account of guarantees of dividends and interest $5,778,553 in 1901 and $4,215,292 in 1902, but only $865,121 in 1903.

On the Prussian State Railroads it is ordered that sleeping and dining-cars carry a green flag, which shall be notice to be very cautious in switching lest the slumber of the passenger be interrupted or a connection be hindered between his cup and his lip.

The True Perspective of the Supply Department.*

BY GEO. G. YEOMANS.†

Touching, first, the least important feature, I rather like the title of supply agent, which has been adopted by some roads to designate the head of this department. To my mind, it means more, and it is intended to mean more, than the title of storekeeper or general storekeeper. We have a general freight agent, a general passenger agent, a purchasing agent and a real estate agent in charge of their respective departments; why not a supply agent, in charge of all the supplies belonging to the company, whether they are in a storehouse or not? Further, it better indicates his true rank as the equal of these other officials, and his right to occupy his proper place on the personal staff of the general manager. It also signifies, to some extent, his emancipation from the direct control of the division superintendent, the master mechanic or the superintendent of bridges and buildings. The storekeepers should report to him but he should also be responsible for and have control over all material of any nature that is not in actual use, regardless of its location.

I have said that his proper place is on the staff of the general manager. I am aware that this is a much discussed and still unsettled question, but if approached by the process of elimination, we may, perhaps, reach a logical conclusion. Should he report to any local or division official? No, because his jurisdiction should extend over all divisions in order to secure the most economical distribution of his supplies; and a divided responsibility is the death warrant of efficient service. Should he report to the head of the mechanical department? Obviously not, because the mechanical department uses only about 30 per cent. of the material which he is called upon to provide and distribute. The same objection applies to the maintenance of way or bridge and building departments. Should he be on the staff of the general superintendent? Again, no. The general superintendent is, strictly speaking, an operating and not a managing official. His division superintendents are his chief lieutenants, and are, and should be, supreme on their respective divisions. The general superintendent would naturally delegate authority over supply matters to them, and they, in turn, to their division master mechanics or roadmasters, and we speedily arrive at the point from which we started with such tremendous effort only a few years ago.

Should he report to the purchasing agent? A great deal has been said and written on this question and opinions differ widely. On a small railroad, where the duties of the purchasing agent are necessarily light, and where the expense of the two separate organizations is an item of importance, it might be admissable; but on any railroad of what we have grown to consider modern magnitude, the answer is just as obviously, no. (1) Because the purchasing agent of a large railroad has his time and attention entirely monopolized in seeing that the funds placed at his disposal are wisely and economically disbursed. If he is studying his profession properly and keeping in close personal touch with the actual needs of the property, the physical conditions surrounding his local sources of supply and the market conditions which must primarily form the basis of sound judgment in his conduct of the business, he could not devote enough time or attention to the supply department to render his supervision other than nominal and perfunctory. (2) Because it is a bad policy, theoretically at least,

*Read at the December meeting of the Western Railway Club.
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to have the receipt and inspection of material in charge of the same person who buys it.

The supply agent should be independent to the extent that he furnishes a complete check on the purchasing agent as to the quantity and quality of the material for which the company's money is expended. This he could not be if his tenure of office depended on the latter. In reaching this conclusion, we are casting no slight upon the members of the purchasing fraternity. We are discussing the organization, not the man; and it must be admitted that any organization which depends wholly on the man is faulty.

By this process of elimination, then, we arrive at the general manager. Who so proper to have the general supervision of this important department as the one man, above all others, to whom the management looks for results? Who so capable of directing the whole policy of a supply department in the production of these results, through his personal representative at its head? Who so able to decide impartially all questions concerning supplies which involve expense of operation to such a marked degree? Every analysis of the subject points unerringly in the one direction. The true importance and the relative rank of the head of the supply department places him upon the personal staff of the general manager.

The relations of the supply department to all of the other departments are so vital, and their mutual interests so closely interwoven, that it is almost a pity that a separate organization should be a necessity; yet, on the other hand, the good that can be accomplished by a well organized and independent supply department, acting as a constant check upon the wasteful or unnecessary use of material, is only just beginning to be realized.

We have heard so much about the desirability of co-operation and harmony between the various branches of the service that the expression has become trite and hackneyed. If one-tenth of the platitudes which have been uttered on this theme had been reduced to practice, there would be little left to talk about in connection with it. The two words are, in a sense, synonymous, the one being the active and the other the passive expression of the idea. You cannot have co-operation without activity as well as harmony, and hence I prefer to use that word. Co-operation means to act jointly with others to the same end; to work or labor with mutual efforts to promote the same object. You will note that one man, or one department, cannot co-operate. It takes at least two. Ask a storekeeper if he is co-operating with a master mechanic. If he is trying his best to work in harmony with him and to render efficient service, he may honestly answer yes; but is he? You can never know until you ascertain whether or not the master mechanic is actively working with him.

Co-operation cannot be one-sided—it cannot be active on the one part and inert or resistant on the other. It is collective work that counts. In this respect, the supply department is the most dependent branch of the service. It must always be fully equipped and yet it is wholly without initiative. In its present shape, it is of comparatively recent origin. It is still, to a certain extent, on probation. We hear a good deal about its co-operating with the older departments, but not much about the other departments working with it. The tendency seems to be for them to sit quietly by and watch the supply department work out its own salvation; "to damn it with faint praise" where there is no fault to find, and with ingenious energy when there is; to feel that they have done their full duty when they have cast no obstacles in its pathway. Such an attitude, such a lack of co-operation in the true sense of the word, not only prevents the supply department from rendering the most efficient service it is capable of, but is reflected in the less efficient work of the other departments themselves.

What I want to impress upon you is the real necessity for more active assistance from the heads of those other departments in order to secure the best results and the best service from the supply department. Let us drop the habitual use of the time worn and overworked excuse of "no material," and devote a little of our spare time and surplus energy to helping the storekeeper out with a few timely suggestions, or a little advance information of expected requirements. Let the general manager recognize more fully the true importance of his supply agent as a valuable member of his staff; include him in all of his inspection trips and so keep him in close touch with physical conditions and contemplated work for which he will be expected to furnish the material; call him in when he is consulting with his general superintendent about a proposed extension, or with his chief engineer regarding the replacing of a bridge or the erection of a building.

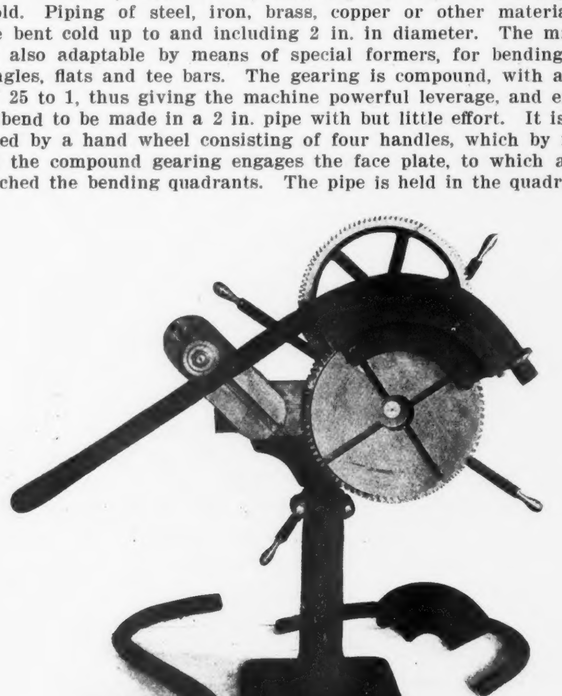
Let the division superintendent and master mechanic make it a point to keep their storekeeper fully advised of probable requirements as far in advance as possible. Tell him when this side-track is to be put in; that stock yard built; or the other water tank erected. Tell him how many locomotives are expected to be shopped next month and the general nature of the repairs; what the prospects are of the number of bad order cars increasing or diminishing in the near future. In a word, co-operate with him to that extent in getting required material on the ground before the men are waiting for it.

Don't let's expect the supply agent to be a clairvoyant or expect the material to be forthcoming if he doesn't know it is wanted; and don't let's expect him to dig out for himself the information that we might so easily give. If the exact material required is not in stock, let us aid the storekeeper by suggesting and accepting reasonable substitutes. Let us see that our requisitions are so clearly and explicitly worded that they cannot easily be misunderstood, even by one who is unfamiliar with the local conditions or shop methods. Don't let us be afraid to say *why* we want, as well as *what* we want. A knowledge of the purpose for which material is required is a great aid to its intelligent selection. When a question is asked by a storekeeper, don't let us attribute it to idle curiosity and reply by saying it's "none of his business." Don't think because we know it all, that it is necessary to keep the other fellow in ignorance, but let us disseminate a little of our knowledge among those who are not so fortunate, and thereby add to the intelligent conduct of the less enlightened branches of the service.

When the heads of all the various departments once fully realize how essential their own active and intelligent efforts are to the success of the supply department and through it to the efficiency of the whole operating organism, the true perspective will have been established and the true capabilities of the department will have been made available.

The Pedrick & Smith Pipe Bending Machine.

The accompanying illustration shows a machine made by Pedrick & Smith, Germantown, Philadelphia, Pa., for bending pipe cold. Piping of steel, iron, brass, copper or other material can be bent cold up to and including 2 in. in diameter. The machine is also adaptable by means of special formers, for bending light angles, flats and tee bars. The gearing is compound, with a ratio of 25 to 1, thus giving the machine powerful leverage, and enables a bend to be made in a 2 in. pipe with but little effort. It is operated by a hand wheel consisting of four handles, which by means of the compound gearing engages the face plate, to which are attached the bending quadrants. The pipe is held in the quadrant at



The Pedrick & Smith Pipe Bending Machine.

one end by a steel plate, while the resistance stud on the movable arm engages the other end. The various curvatures are obtained by adjusting the arm, which has a swing of three-quarters of a circle supplemented by the movement of the resistance stud in the "T" slot on the arm. The machine is mounted on a telescopic stand which can be raised or lowered to any suitable height; when the base is fastened the upper part swivels. A universal arm or section for the stand is furnished so that if desired the face plate may be placed in a horizontal position at any height from the floor. Quadrants are furnished with the machine for 1-in. pipe with a radius of 6 in.; for 1¼-in. pipe with a radius of 9 in.; for 1½-in. pipe with a radius of 12 in., and for 2-in. pipe with a radius of 14 in. While only four quadrants are furnished with the machine it has been demonstrated that smaller size pipe can be bent in the larger size quadrants very satisfactorily. In fact, workmen will not take the time to change the quadrants unless they desire a shorter radius than the larger quadrant will give them.

GENERAL NEWS SECTION

NOTES.

A bill will be introduced in the Canadian Parliament at the next session, and undoubtedly will be passed, to pension the old employees of the Intercolonial (Government) Railroad. There are about 300 men on the road who will probably be retired. Mr. Emmerson, with engaging frankness, says that it will not be necessary to fill the vacated positions.

It is announced that the new through train between St. Louis and the City of Mexico, which is to be put in service January 16, is to run through in about 55 hours, a somewhat shorter time than was named in the first announcement. This train will run twice a week each way, and will carry only sleeping car passengers. It runs over the St. Louis, Iron Mountain & Southern, the Texas & Pacific, the International & Great Northern and the National Railroad of Mexico.

The principal railroads of the State of Washington, after a conference with the State Railroad Commissioners, have decided to restore, with some alterations, the joint through freight rates which were abolished some time ago. The new agreement includes Tacoma and all non-competitive territory on the Oregon Railroad & Navigation Company's line. The new rates will also cover live stock, hay, grain, coal and other articles not before included. The newspapers say that the new rates show substantial reductions on many articles between eastern Washington and the cities on Puget Sound, and that the decision to adopt these rates is a victory for the Railroad Commission.

Shipments of Iron Ore in 1905.

The *Marine Review* estimates the total ore shipments by lake during 1905 as 33,476,904 tons, which is 12,250,313 tons in excess of the movement of last year. To these figures is yet to be added the all-rail movement which will probably exceed 500,000 tons, so that the total movement of ore from the Lake Superior mines during 1905 will be 34,000,000 tons. The 1905 movement is, therefore, over 6,000,000 tons greater than the movement of 1902, and is the record-breaking movement on the great lakes. Of this great movement the Oliver Iron Mining Co. shipped 18,779,374 tons. Shipments during December aggregate 405,060 tons, an increase of 38,689 tons over the movement of the corresponding month last year. The shipments by months during the year have been as follows: April, 1,195,173 tons; May, 4,619,431 tons; June, 4,999,451 tons; July, 5,224,619 tons; August, 5,009,382 tons; September, 4,425,550 tons; October, 4,257,009 tons; November, 3,341,229 tons; December, 405,060 tons.

Following were the shipments by ports during the month of December and during the full season, with comparative data for the previous year:

	December		Season	
Port.	1904.	1905.	1904.	1905.
Escanaba	137,344	131.553	3,644,267	5,307,938
Gladstone	....	....	480	....
Marquette	40,410	52,578	1,907,301	2,977,828
Ashland	18,422	25,224	2,288,400	3,485,344
Superior	37,926	75,151	4,169,990	5,118,385
Duluth	75,599	39,853	4,649,611	8,807,559
Two Harbors	56,670	80,701	4,566,542	7,779,850
Total	366,371	405,060	21,226,59.	33,476,904
Increase for 1905		38,689		12,250,313

Standard Locomotives for India.

The British Engineering Standards Committee has just issued a revised edition of its report on standard locomotives for Indian railroads, embodying some slight changes in detail which have been suggested by experience of the standard engines already built according to its specifications. The designs provide for five engines, two for the broad 5 ft. 6 in. gage and three for the narrow meter gage. The former comprise a passenger engine of the American or 4-4-0 type and a goods engine of the six-coupled 0-6-0 type, and the latter a 4-6-0 passenger engine, a mixed traffic or goods engine of the same type, and a goods engine of the 4-8-0 or Mastodon type. The two broad gage engines are identical in regard to their boilers, as indeed they are in every other respect, except so far as differences are involved by the different sizes and arrangement of the wheels. The total heating surface is 1,349.5 sq. ft., with a grate area of 25.3 sq. ft.; the steam pressure is 180 lbs., and the cylinders have a diameter of 18½ in. with a stroke of 26 in. But the passenger engine has driving wheels of 6 ft. 2 in. diameter, including 3 in. tires, while those of the goods engine are of 5 ft. 1½ in. diameter, also including 3 in. tires, and the total weight in working order, exclusive of tender, is 51 tons for the former and 48 tons for the latter. The weight on the axle of each pair of driving wheels is 16.25 tons in each case except that of the rear axle of the goods engine, on which it is 15.5 tons. The tenders are the same for both engines; they are carried on six wheels, weigh 39.5 tons in working order, and have a capacity for fuel of 7½ tons and for water of 3,000 gallons. For the three meter gage engines the boilers again are all the same, having Belpaire fireboxes, with a heating surface of 1,062 sq. ft., a grate area of 16 sq. ft., and a working pressure of 180 lbs. The stroke is 22 in. in each case, but the diameter of the cylinders is 15½ in. for the passenger engine, 15 in. for the mixed traffic engine, and 16 in. for the goods engine. The diameters of the driving wheels are 4 ft. 9 in., 4 ft., and 3 ft. 7 in., all the tires being 2½ in. The engines weigh in working order 33.70 tons, 33.30 tons, and 39.50 tons, the weight on each driving axle being 8.7 tons, 8.6 tons, and 8 tons. The six-wheeled tenders for these engines weigh 22.95 tons, and hold four tons of fuel with 2,000 gallons of water.

In its original report the committee pointed out that these designs, especially as regards the broad-gage, only provided for engines and tenders of the type which it was thought would prove most useful at the present time on the majority of Indian railroads; but it intimated its opinion that it would be found necessary to design other types for heavy passenger and goods work, as well as for special use in hilly country and for shunting purposes. The justness of this opinion has since been demonstrated by a request from the Secretary of State for India that the committee will consider the advisability of standardizing three types of broad-gage locomotives of a heavier type—a request which is now receiving attention.

Mr. Prouty Decides in Favor of the Railroad.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced it decision in the case of Artz against the Seaboard Air Line. It appears that the carrier's passenger fare from Fernandina, Fla., to Savannah, Ga., 124 miles, is $5, or about 4 cents per mile, while a rate of 3 cents per mile is fixed by state authority for fares within the states of Florida and Georgia. The carrier's line between Savannah and Fernandina or Jacksonville is more expensive to maintain than other parts of its system, and the freight traffic is light and the local passenger traffic insignificant. A reduction of this interstate passenger fare would not contribute to the development of the section or increase materially the passenger business of the line. Reducing the fare to 3 cents per mile would render the earnings of this part of the system less than the average upon the whole system and less than the average in that part of the country of other roads.

The Commission holds that ordinarily the through interstate passenger fare should not exceed the sum of local fares, but there is no specific requirement in the regulating statute to that effect and the only question for determination is whether the fare complained of is unreasonable. It is held that upon all the circumstances the fare in question cannot be deemed excessive and the complaint is therefore dismissed.

Took Him at His Word.

Paul Morton, at a convention of railroad men, said of the railroad hog:

"I wish that all these men could be treated as a certain Marylander once was. The Marylander boarded a train with two armloads of bundles. He sat down, and piled his bundles beside him. Then he opened a paper and began to read in great comfort. The car by degrees grew crowded. At last the only vacant seat was the bundle-filled one beside the Marylander. Though several passengers hesitated beside this seat, looking at the Marylander wistfully, he made no sign. He would rather let the people stand than remove his goods. Finally someone summoned the conductor. He hurried in and said:

" 'Take down those bundles, please, at once. Don't you see, sir, that there are ladies standing all about you?'

"The Marylander was a perfect example of the railroad hog. He said in a blustering tone:

" 'What is the matter with you? Those bundles don't belong to me. They belong to a man in the smoker.'

" 'All right,' said the conductor. 'I'll pile them up here, then, till he comes.' And he put the bundles in the rack overhead, and gave the vacant seat to a lady.

"The Marylander laughed because he had not had to move his bundles himself; but, when he came to get off, he did not laugh so heartily. As he was gathering his precious pile together, the conductor hurried to him and said sternly:

" 'Don't touch those packages, sir. They belong to a gentleman in the smoking car.'

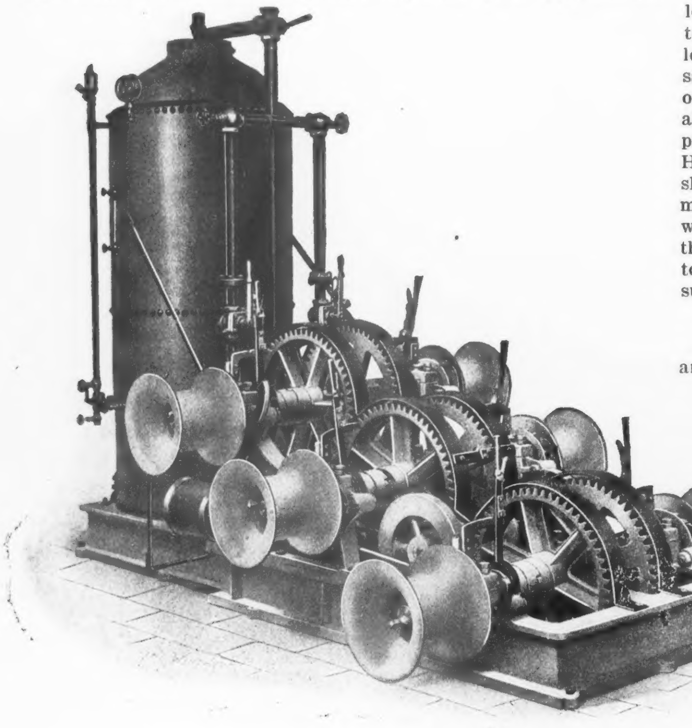
" 'Ah, what's the matter with you?' snarled the other. 'They belong to me.'

" 'You said they didn't,' answered the conductor, 'and I am going to take you at your word. The only way you can get them is to come and identify them at our main office to-morrow.' "—*Express Gazette*.

Lidgerwood Improved Erecting Engine.

The accompanying illustration shows the latest type of Lidgerwood hoisting engine, made by the Lidgerwood Manufacturing Co., New York. This engine is specially designed and largely used in bridge erection work as well as in the construction of iron buildings. It is equipped with winches or spools instead of drums on account of the large amount of rope usually to be wound in this class of work, and the fact that with the winch or spool the quantity that can be taken care of is practically unlimited.

The spools are all keyed fast to the shafts, which are independent and supported by a central bearing. Each spool-shaft has its own gear running loose on the shaft, and fitted with a jaw clutch. The jaw clutches are of the Lidgerwood improved spiral type, and can



Lidgerwood Improved Erecting Engine.

be thrown in at any position by small hand levers which have thumb-latches, engaging with notches on the quadrants, so that when the clutches are thrown in they cannot come out, and when thrown out there is no danger of their accidentally becoming engaged. The spools being independent enables the engine to be operated to great advantage in bridge erection, as several members of a truss or girder can be hoisted and held in position while they are being bolted or riveted. By having several men at the engine these members can be hoisted simultaneously, the number hoisted being limited only by the hoisting capacity of the engine and the number of spools. By making fast to each end of a long and heavy girder, and by hoisting first on one end and then on the other, a much greater weight can be handled than by means of a drum hoist. The tackle can also be multiplied as much as desired, since any amount of rope can be wound on the spools. This engine is especially well proportioned for the severe character of hoisting duty it has to perform. The bed-plate is in one piece, and is widened in front so that the working parts of the engine are all inside of the side frames. This leaves the winches clear so they can be operated without danger to the man handling the lines. The shaft bearings are wide, and the shafts are of the best hammered steel and unusually large, to withstand the strain due to handling heavy weights on the overhanging spools. The gearing is extra strong and heavy, and the engine can be operated from either side. An important element in the success of this engine lies in the form of the spool, which is especially adapted to the class of work for which the engine is designed to be used. When desired the engine can be equipped so as to be seld-propelling in either direction.

Pensions on the New York Central.

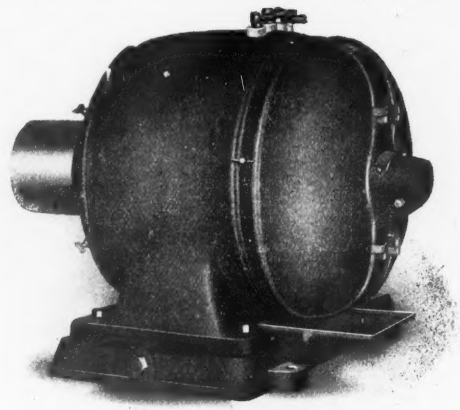
The directors of the New York Central and of the railroads allied with it have decided to pension their old employees, and a committee has been appointed to prepare a plan. An age limit will be established, and there will be regulations for the retirement of the superannuated, similar to those now in force on a number of other roads. The members of the committee are Vice-Presidents W. C. Brown and John Carstensen, General Superintendent Deems of the Mechanical Department, and the General Managers of the four principal roads in the New York Central system—Messrs. A. H. Smith, W. H. Marshall, R. H. L'Hommedieu and C. E. Schaff. Before long this committee will make its report, establishing the rules and regulations, and naming the date when pension allowances will begin.

Chicago Outclassed.

A suit brought against the Taff Vale Railway for compensation for injuries has revealed an example of nerve for which it is difficult to find a parallel; that of a man who deliberately lay in front of a train and had his legs cut off. The plaintiff claimed that the jolt of a train threw him against a door, which opened and allowed him to fall across the track. The train passed over both his legs, which had to be amputated. The company produced evidence which left no trace of doubt that the plaintiff had not traveled by the train, but had deliberately placed his legs on the tracks and allowed the train to run over them for the sake of getting compensation from the company and £500 from the proprietors of a periodical which offers that sum to any reader who loses both legs above the ankles in a railway accident while in possession of the paper. When the plaintiff was found he was perfectly conscious. He produced three pocket handkerchiefs, tied them together and showed the man who found him how to make a tourniquet. The man himself properly adjusted the bandage. The fact that there was not the slightest mark on either his body or his clothes, although he weighs 210 pounds, and the train from which he claims to have fallen was traveling at the rate of 30 miles an hour, aroused suspicions and inquiries followed.—*London Press Despatch.*

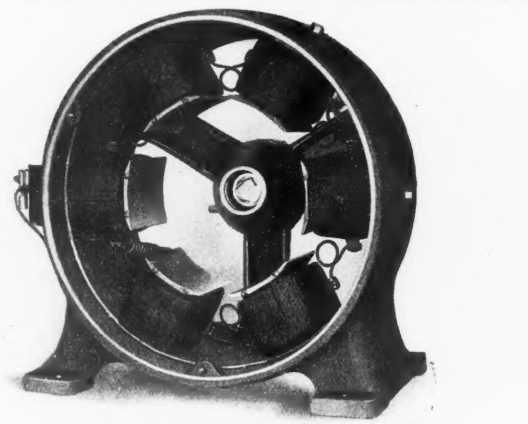
The Sprague Type D Direct Current Motor.

The accompanying illustrations show the general appearance and design of the new type D motor made by the Sprague Electric



The Sprague Enclosed D 4-Pole Motor.

Company, New York. These motors are made in nine different sizes of frames, ranging from 10 h.p. to 90 h.p. for standard slow speeds, and from 15 h.p. to 105 h.p. for standard moderate speeds. They are fitted with either shunt, series or compound wound field



Yoke of the Sprague Type D 6-Pole Motor.

windings for use on 115, 230 or 500-volt d.c. circuits. They are made entirely enclosed, semi-enclosed and open. The small sizes are bipolar, but from 20 h.p. up they are multipolar.

Stay-Bolt Iron for the Harriman Lines.

The Bethlehem Steel Company has been awarded the contract for furnishing stay-bolt and boiler brace iron to all of the Harriman lines in such quantities as may be required during the year

1906. The Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Co., Southern Pacific and the Chicago & Alton are to be supplied under this contract. The Bethlehem Steel Company has recently erected a new mill for making high-grade stay-bolt iron, and is furnishing it in large quantities to many of the largest railroads in the United States and Mexico.

New Dining Cars on the London & North-Western.

The London & North-Western has recently introduced on its lines some dining cars of the American type with movable individual seats which are an innovation in British practice. In the usual

Interior of London & North-Western Dining Cars.

types of British dining cars the seats are fixed and heavily cushioned, much after the style of the seats in the compartments. The new cars are 65 ft. 6 in. long over body and 69 ft. 6 in. long over buffers. The width over eaves is 9 ft., and the height from rail to top of roof is 8 ft. 7 in. They are mounted on two six-wheel trucks, having a wheel-base of 11 ft. 6 in. The cars were built at the Wolverton Works from the designs of Mr. C. A. Park, Carriage Superintendent of the London & North-Western.

Bids for Philippine Railroads Rejected.

All the bids recently submitted for concessionary contracts or grants for the construction of railroads in the Philippine Islands were rejected by the Bureau of Insular Affairs, because the bidders did not conform to the strict specifications called for in the proposal. The Bureau will advertise for new proposals to be opened January 20. The terms will be modified.

Manufacturing and Business.

H. B. Underwood & Co., makers of special tools for railroad repair shops, Philadelphia, Pa., are distributing their 1906 calendar, and will be glad to send a copy to any one interested.

The Bettendorf Axle Company, New York, has received an order from the Southern Railway Co. for 30,000 bolsters and 1,000 cast-steel trucks. This, we believe, is the largest single order ever placed for bolsters.

The Midland Navigation Company of Canada is to have built at Collingwood a lake steamer to be 450 ft. long and with capacity to carry 9,000 tons of grain. This will be the largest Canadian steamer on the lakes.

The November and December issue of *The Obermayer Bulletin* of foundry information is being distributed by The S. Obermayer Co., Chicago. It contains a number of articles on foundry practice and management, as well as its usual amount of light reading matter.

The Telegraph Signal Company has filed a certificate of incorporation with the Secretary of State at Albany, N. Y.; capital, $1,000,000. The company proposes to make an electrical device for enabling a train despatcher to arouse inattentive operators at stations along the line, and to remove difficulties due to accidental grounding of a wire at way stations. Among the directors are John McGarvey, Superintendent of the Buffalo, Rochester & Pittsburg Railway at Rochester, N. Y., and James G. Halleran, of Oswego, N. Y. The inventor of the device is S. A. Wright, of Morton, N. Y.

The American Blower Company, of Detroit, is furnishing mechanical draft apparatus for the Huntsville (Alabama) Railway, Light & Power Company; the New York, Susquehanna & Western Railway Company at Rochelle Park, N. J.; the C., B. & Q. Railway Company at St. Paul and Chicago; the Lackawanna Coal Company at Olyphant, Pa., and the Lehigh Coal & Navigation Company at Lansford, Pa. It is also furnishing heating apparatus for some of the Pennsylvania Railroad Company's new shops at Allegheny; for the Lincoln ark shops of the B., R. & P. Railway at Rochester; Kingsland, New Jersey, shops of the Delaware, Lackawanna & Western, and for the Schenectady Works of the American Locomotive Company.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—D. F. Kirkland, Superintendent at Waycross, Ga., has resigned.

Canadian Northern.—W. A. Brown, Superintendent at Port Arthur, Ont., has been appointed General Superintendent, with office at Winnipeg, Man.

Canadian Pacific.—W. S. Painter has been appointed Architect, with office at Montreal.

Chicago, Burlington & Quincy.—F. E. Kennedy has been appointed Master Mechanic at McCook, Neb., succeeding R. B. Archibald, resigned.

Colorado & Southern.—J. H. Bradbury, Assistant General Auditor, has been elected General Auditor, with office at Denver, Colo., succeeding A. D. Parker, promoted. J. S. MacKie has been elected Secretary and Treasurer, succeeding H. Bronner, who remains on the executive committee.

Lehigh & Hudson.—M. Rutherford, General Freight and Passenger Agent, has been elected Vice-President and General Manager. H. G. Pierson succeeds Mr. Rutherford.

Louisville & Atlantic.—R. N. Hudson, Roadmaster and Chief Engineer of the Louisville, Henderson & St. Louis, has been appointed General Manager of the L. & A., effective January 1.

Louisville & Nashville.—F. Kesler, Acting Assistant Superintendent at Birmingham, Ala., and previously Trainmaster, has been appointed Assistant Superintendent, succeeding E. J. Haylow, deceased.

Louisiana & Northwest.—J. J. Nelson has been elected President, with office at St. Louis, succeeding C. O. Ferguson. H. C. Brown, Manager, has been elected Vice-President, with office at Magnolia, Ark., succeeding J. O. Richardson. Mr. Richardson has been elected Secretary, with office at Homer, La., succeeding A. R. Porterfield.

Missouri & Illinois Bridge & Belt.—William Graham, Superintendent, has resigned. Arthur Hamilton succeeds Mr. Graham, with office at Alton, Ill.

W. L. Bedison, Auditor, has resigned.

Missouri, Kansas & Texas of Texas.—C. H. Scott, Trainmaster at Smithville, has been appointed Superintendent at Greenville, Tex., succeeding W. E. Williams, resigned to go to the Missouri, Kansas & Texas.

New York, Westchester & Boston.—F. H. Bull has been elected Vice-President and a Director.

Pullman.—F. E. Rice, District Superintendent at St. Paul, has been appointed Manager of the Western division, with office at Chicago.

Southern.—M. M. Richey, Assistant General Superintendent at Birmingham, Ala., has resigned.

J. W. McCay, formerly Roadmaster on the Evansville & Princeton Traction, has been appointed Superintendent of the Evansville, Rockport and Cannelton branches of the Southern.

Union Pacific.—W. R. Kelly, General Solicitor, has resigned, effective January 1.

Wabash.—F. E. Signer, Manager of the Lehigh & Wabash Despatch, has been appointed Assistant General Freight Agent of the Wabash, with office at St. Louis, effective January 1. He will be in charge of all the fast freight business done by the Wabash lines.

LOCOMOTIVE BUILDING.

The Nevada Consolidated Copper Company has ordered three 8-in. x 14-in. standard gage mining locomotives from the H. K. Porter Co.

The Sierra Railway Company, of California, has ordered two 10-in. x 16-in. oil burning locomotives of 30-in. gage from the H. K. Porter Co.

The Cuba Eastern is reported in the market for two 90,000-lb. mogul locomotives and one 60,000-lb. switching locomotive. Mr. De Zayas is Purchasing Agent, Orient Building, 79 Wall street, New York.

The Kilpatrick Bros. & Collins Contracting Company, Omaha,

Neb., has ordered three 10-in. x 16-in. 36-in. gage contractors locomotives of 36,000 lbs. each, and two 14-in. x 20 in. standard gage locomotives of 68,000 lbs. each from the H. K. Porter Co.

The Minneapolis & St. Louis, as reported in our issue of December 1, has ordered eight simple mogul (2-6-0) locomotives from the Schenectady Works of the American Locomotive Co., and two switching locomotives from the Baldwin Locomotive Works, instead of from the American Locomotive Co., as reported in our issue of December 22. The mogul locomotives will weigh 140,000 lbs., with 118,950 lbs. on the drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 64 in.; extended wagon top boiler, with a working steam pressure of 200 lbs.; 316 Otis steel tubes, 2 in. in diameter and 147 in. long; Otis steel firebox, 96½ in. x 62 in.; and tank capacity, 7,000 gallons of water. The special equipment includes: "She" bell ringers and sanding devices, Franklin boiler lagging, Simplex brake-beams, Street-Perfecto brake-shoes, Wabash headlights, Monitor and Ohio injectors, Damascus journal bearings, Jerome's piston and valve rod packings, Ashton safety valves and steam gages, Nathan sight-feed lubricators, A. French Spring Co.'s springs, Taafel's steam heat equipment, Midvale driving wheel tires, and Boies truck and tender wheel tires.

The Mobile & Ohio has ordered 10 simple ten-wheel locomotives from the Baldwin Co. These locomotives will weigh 170,000 lbs., with 130,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 62 in.; wagon top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,944 sq. ft.; 361 Detroit seamless steel tubes, 2 in. in diameter and 15 ft. long; Otis firebox, $120^{3}/_{16}$ in. x 41⅛ in.; grate area, 34 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity, 15 tons. The special equipment includes: Westinghouse air-brakes, Western bell ringers, Manville boiler lagging, Damascus brake-beams, Streeter brake-shoes on tender, Gould couplers, Pyle and Dressel headlights, Ohio injectors, Ajax journal bearings, U. S. metallic piston and valve rod packing, Consolidated safety valves, Leach sanding devices, Chicago sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, Ashcroft steam gages, Latrobe driving, truck and tender wheel tires, also Paige steel-tired engine and tender truck wheels, Miner tandem draft gear on tender, Elvin driving box lubricator, Bordo blow-off cocks, Brewer fire door opening device, and Scully-Gallagher tender bolsters.

CAR BUILDING.

The Raleigh & Pamlico Sound, it is reported, has ordered 500 cars.

The Chicago, Burlington & Quincy is in the market for 1,000 box cars.

The East Carolina, it is reported, is in the market for one passenger coach.

The Zanesville & Crooksville has ordered one express car from the Jewett Car Co.

The Zanesville & Southeastern has ordered one express car from the Jewett Car Co.

The Minneapolis & St. Louis has ordered one cafe observation car from the Pullman Co.

The Rogers & Southwestern is figuring on new equipment. Address J. E. Felker, Rogers, Ark.

The Evansville & Terre Haute has ordered 1,500 coal cars from the American Car & Foundry Co.

The Aurora, Elgin & Chicago Ry. Co., Chicago, has ordered one express car from the Jewett Car Co.

The National Packing Company, Chicago, will shortly be in the market for a number of beef cars.

The Quebec Central is considering the purchase of 20 stock and refrigerator cars and six passenger cars.

The Tidewater, it is reported, will shortly be in the market for upwards of 1,200 additional freight cars.

The Chicago Great Western, it is reported, will probably build 200 box cars in its own shops early in 1906.

The St. Louis, Rocky Mountain & Pacific is figuring on the purchase of two combination cars and one coach.

The Interborough Rapid Transit, New York, is figuring on material for 10 passenger cars to be built at its own shops.

The New York Central has ordered 50 passenger coaches, 30 baggage cars, and four cafe cars from the Pullman Co.

The Boston & Worcester (Electric), it is reported, will shortly ask bids on a number of semi-convertible cars 52 ft. long.

The Buffalo, Rochester & Pittsburg will shortly be in the market for additional equipment to that reported in our issue of December 8.

The Northern Pacific has ordered 10 dining cars, 11 tourist sleeping cars, 15 baggage cars, and 30 passenger coaches from Barney & Smith.

The Boston & Maine has ordered 1,000 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co. and 500 box cars from the Pullman Co.

The Cuba Eastern is reported in the market for 80 box cars of 60,000 lbs. capacity and seven passenger cars. Mr. De Zayas is Purchasing Agent, Orient Building, 79 Wall street, New York.

The Buffalo, Rochester & Pittsburg has ordered ten 66-ft. passenger cars and two 66-ft. combination passenger and baggage cars from the Pullman Co. These cars are for May, 1906, delivery, and will be equipped with wide vestibules.

The General Chemical Company, New York, has ordered 20 tank cars of 6,600 gallons capacity from the Bettendorf Axle Co. The special equipment will include Bettendorf cast-steel trucks and I-beam bolsters, Griffin wheels, Westinghouse brakes, Monarch brake-beams, Climax couplers and Camel journal bearings.

The Chicago, Rock Island & Pacific has ordered from the American Car & Foundry Co. 3,000 box cars, 250 dump cars. about 1,000 stock cars, 10 cabooses, 22 coaches, six combination mail and baggage cars, six combination baggage and passenger cars, seven baggage cars, and five buffet and five postal cars. It is also reported that this company will shortly order two dining cars.

The Intercolonial, as reported in our issue of December 15, has ordered 25 box cars from the Rathbun Co. These cars will have a capacity of 60,000 lbs. and will weigh 34,800 lbs. They will measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high inside. The bodies and underframes will be of wood. The special equipment will include: Simplex bolsters and brake-beams, Christie brake-shoes, Westinghouse air-brakes, Dunham door fittings, Chicago doors, Miner tandem draft rigging, Harrison dust guards, Chicago roofs and Simplex trucks.

The Denver, Northwestern & Pacific, as reported in a previous issue, has ordered two combination cars and six passenger coaches from the Pullman Co. The combination cars will have a capacity for seating 20 persons and the coaches for 70. The cars will measure 60 ft. long over sills, 9 ft. 8 in. wide and 6 ft. 10 in. high. The special equipment will include: Pullman axles, double cast-steel bolsters, Diamond special brake-beams, Streeter steel-back brake-shoes, Westinghouse brakes, Magnus Metal Co.'s brasses, National couplers, Westinghouse draft rigging, Martin steam heating system, Pintsch light, Pullman springs and Paige wheels.

The Tacoma Eastern, as reported in our issue of December 15, is building at its own shops 50 flat cars and one observation car. The flat cars will have a capacity of 80,000 lbs., and will weigh 27,500 lbs. They will measure 41 ft. long x 8 ft. 6 in. wide inside. The bodies and underframes will be of wood. The special equipment will include: American cast-steel bolsters, Sterlingworth brake-beams, Westinghouse brakes, Tower couplers, twin spring draft rigging, American steel trucks and Griffin wheels. The observation car will weigh 68,000 lbs., and will measure 65 ft. long x 10 ft. wide x 14 ft. high, all inside dimensions. The special equipment will include: Sterlingworth brake-beams, Westinghouse brakes, Tower couplers, Forsyth curtain fixtures, Pantasote curtain material, Adams & Westlake door fastenings, Monitor roofs, six-wheel trucks and Griffin wheels.

The Mobile & Ohio, as reported in our issue of December 1, has ordered 900 box cars of 60,000 lbs. capacity, 2,000 gondolas of 80,000 lbs. capacity, and 100 furniture cars from the American Car & Foundry Co. All of these cars are to be delivered within 60 days. The box cars will weigh approximately 3,400 lbs., and measure 36 ft. long x 8 ft. 6 in. wide x 8 ft. high, inside measurements. The gondolas will weigh 3,400 lbs., and measure 37 ft. 1½ in. long x 9 ft. 8 in. wide x 3 ft. 9 in. high, all inside measurements. The furniture cars will be 45 ft. 2½ in. long, 8 ft. 6 in. wide and 9 ft. high, all inside measurements. The special equipment includes: Scully-Gallagher bolsters, Damascus brake-beams, Westinghouse air-brakes, Jones doors for box and furniture cars, Miner draft rigging, Patterson-Sargent paint, Chicago roofs for box and furniture cars, Pittsburg Spring & Steel Co.'s springs and arch-bar trucks.

BRIDGE BUILDING.

EDMONTON, ALBERTA.—An official writes that the Department of Public Works of the Province of Alberta will build a bridge over Bow marsh and the Bow river, opposite Calgary. Contracts for the superstructure have been let to the Canadian Bridge Co., of Walker-

ville, Ont. It will be a combined highway and street car bridge 540 ft. long and cost about $50,000.

MOBILE, ALA.—Bills were introduced in the United States Senate Dec. 14 and in the House of Representatives Dec. 15, authorizing the Mobile Railway & Dock Company to build and maintain a bridge or viaduct across the water between the end of Cedar Point and Dauphin Island.

NOME, ALASKA.—On Dec. 19 a bill was introduced in the U. S. Senate authorizing a free bridge across the Snake river at Nome, Alaska.

PENNSYLVANIA.—A bill was introduced in the House of Representatives Dec. 19 authorizing the Fayette Bridge Company to build a bridge across the Monongahela river from a point in the Borough of Brownsville, Fayette County, to a point in the Borough of West Brownsville, Washington County, Pennsylvania.

ST. PAUL, MINN.—A bill has been introduced in the House of Representatives authorizing a bridge across the Mississippi river between the military reservation at Fort Snelling and St. Paul, Minn.

TEXAS.—In the U. S. Senate on Dec. 18 a bill was introduced authorizing the Jasper & Eastern Ry. Co. to build and operate a railroad bridge across the Sabine river in the states of Louisiana and Texas.

WENATCHEE, WASH.—A steel bridge will be built over the Columbia river at this place. Work is to be commenced as soon as material can be delivered. The Wenatchee Development Co. and the Wenatchee Canal Co. will furnish $100,000, and the citizens of Wenatchee the remaining $20,000. The bridge will carry an inverted syphon connected with the present pipe line and ditch system. Water will be furnished for the irrigation of 20,000 acres of land on the east side of the Columbia.

YANKTON, S. DAK.—On Dec. 19 the U. S. Senate passed a bill extending the time for commencing construction of a bridge across the Missouri river by the Yankton, Norfolk & Southern Ry. Co., to March 9, 1907.

Other Structures.

ANNAPOLIS, MD.—Bids were opened at the Navy Department, Washington, D. C., last week for the construction of the foundation for the first building for the experiment station at the Naval Academy for the use of the Bureau of Steam Engineering. Two bids were received, one from the Noel Construction Company, of Baltimore, Md., at $76,000, and one from the Latta & Terry Construction Company, of Camden, N. J., at $68,990.

INDIANAPOLIS, IND.—The board of directors of the Cleveland, Cincinnati, Chicago & St. Louis, it is said, has authorized the building of extensive shops here.

MCKEESPORT, PA.—The Pittsburg & Lake Erie has started work on a large roundhouse to cost, with other improvements, about $200,000.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad is planning to put up a large steel frame and brick building on Mission street between Eleventh and Twelfth streets, the lower floor of which will be used as the main passenger terminal of its new electric line running to Santa Cruz, a distance of 83 miles.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BEAUFORT & WESTERN.—An officer writes that this company has given a contract to the General Contracting & Engineering Co., 15 Whitehall street, New York, for building its proposed line from Morehead City, N. C., east to Beaufort, a distance of three miles.

BRANDON, SASKATCHEWAN & HUDSON BAY.—An officer writes that this company, which was recently incorporated, was granted a charter to build a railroad from the international boundary to Brandon and that it let a contract in September for building the entire line. The road has now been completed for several miles. When completed, the line will connect with the Great Northern at St. Johns, N. B. The offices of the company are at Brandon, Man., and the directors include: K. Campbell, A. S. Frazer, Charles Whitehead and others, of Brandon.

CHESTERFIELD & LANCASTER.—An officer writes that a contract has been given by this company to O. H. Page & Son, of Cheraw, S. C., for building its road from Ruby, S. C., west to Lynches river, a distance of 18 miles.

CINCINNATI, BLUFFTON & CHICAGO.—An officer writes that this company is planning to build extensions from Huntington, Ind., southeast to Bluffton, and from Portland southeast to Union City. The aggregate length of the lines will be 45 miles. (See Construction Record.)

DELAWARE, LACKAWANNA & WESTERN.—This company, it is said, will build a cut-off across Warren County, N. J., 25 miles long. The proposed line will start at Washington and run to the Water Gap. Such a line will be shorter than the main line, and eliminate a number of curves.

DES MOINES & MISSOURI.—This company, which is being financed by George Fernald & Co., bankers, of Boston, has secured rights of way for its proposed line from Des Moines, Iowa, south to Seymour, a distance of 80 miles. The proposed road will run through part of Warren County, the west half of Marion County, and through Lucas and Wayne Counties to Seymour, where connection will be made with the Chicago & Kansas City division of the Chicago, Milwaukee & St. Paul. The road will penetrate large coal fields, part of which are under option to George G. Wright, Clark M. Garver and others, of Des Moines.

DULUTH, SOUTH SHORE & ATLANTIC.—According to reports, this company's line will be extended from the head of Lake Superior west to Thief River Falls, a distance of 200 miles, where connection is to be made with the new line of the Minneapolis, St. Paul & Sault Ste. Marie from Thief River Falls, to Kenmare, N. Dak. The proposed line will run through rich agricultural territory, and will parallel the Great Northern for part of the distance.

GAINESVILLE MIDLAND.—An officer writes that this company has given a contract to the Gwathmey & Mackall Engineering Co., of Norfolk, Va., for building an extension from Jefferson, Ga., southwest to Athens, a distance of 18 miles. The company is also, with its own forces, changing the present line from Gainesville to Jefferson, a distance of 23 miles, from narrow to standard gage. (October 27, p. 134.)

KANSAS, OKLAHOMA, TEXAS & GULF.—An officer writes that this company, which was incorporated last year, has done nothing towards building its proposed line. Surveys are being made and rights of way are being secured. Construction work is to be commenced at Granite, Okla. T., in February, 1906, and will be continued for 35 miles west to the Eggleston Industrial Company's works. The company will build a spur about three miles long at Granite, and expects to have the work completed in six months. Thomas L. Eggleston, of Granite, Okla. T., is President. (See Construction Record.)

KETTLE VALLEY.—Surveys are being made by this company to build a line from Bannock City, 12 miles from Grand Forks, B. C., to Franklin Camp, a distance of 40 miles.

KINGSTON & PEMBROKE.—This company, an officer writes, proposes to build a line from Sharbot Lake, Ont., northeast to Carleton Junction, on the Canadian Pacific, a distance of 40 miles. (See Construction Record.)

LOUISVILLE & NORTHERN RAILWAY & LIGHT.—This company, which has a capital of $5,000,000, it is said, has begun the work of building a system of electric lines in southern Indiana to connect with Louisville or with the line of the Louisville & Southern Indiana Traction. The first section to be built will be from Jeffersonville to Sellersburg, a distance of 12 miles, and this will be followed by lines to Corydon, French Lick, West Baden and other lines in the southern portion of the state. The incorporators are officials of the Chicago company which bought the public utilities of New Albany and Jeffersonville.

MIDLAND OF MANITOBA.—An officer writes that this company, which was granted a provincial charter to build a railroad from Portage la Prairie southwest to the United States boundary line, will probably build its line through Gretna, Man. Contracts for building several miles near Portage la Prairie have been let and grading is under way on this section. The offices of the company are at Portage la Prairie, and the directors include: James Fisher, of Winnipeg; Edward Brown and Charles Anderson, of Portage la Prairie.

MOREHEAD & NORTH FORK.—An officer writes that this company, which was recently incorporated in New Jersey, is to build a railroad from Morehead, Ky., west to north fork of Licking river, a distance of about 14 miles. Contracts have not yet been let. The work includes the boring of one tunnel. E. W. Hass, of Clearfield, Pa., is Chief Engineer. (December 1, p. 176.)

NICOLA, KAMLOOPS & SIMILKAMEEN COAL & RAILWAY.—An officer writes that work was commenced last June on this proposed road from Spence's Bridge, B. C., on the Canadian Pacific southeast for a distance of 40 miles to the coal mines, and that 75 per cent. of the grading is completed. Track laying has been commenced. The work on the first 15 miles was very heavy, being along the face of a steep rocky bluff. On the remainder of the road, 25 miles, the work is light. The maximum grade is 1 per cent. The line rises continuously from Spence's Bridge to its terminal at the coal mines, where the elevation is about 1,200 ft. The maximum curvature is 12 degrees. There will be nine Howe truss bridges on masonry abutments and one tunnel about 400 ft. long. Loss, MacDonnell &

Co. are the contractors. A. J. Cambie, of Spence's Bridge, is Chief Engineer.

NORTH COAST.—This company, it is said, has completed surveys for its proposed road, which is to run from Seattle, Wash., to Wallula. The survey follows the Cowlitz Valley southeast of Tacoma and runs up the valley through Cowlitz Pass and along the Teiton river to North Yakima. From that point it has not yet been determined which survey will be adopted.

NORTHERN ELECTRIC COMPANY.—To the 26 miles of standard gage road in course of construction by this company, from Chico to Oroville, Cal., will be added lines from Marysville to Meridian, and from Yuba City to Live Oak. The street railway line at Marysville has been bought, and will be rebuilt at once as an electric road. The new articles of incorporation filed by the Northern Electric, give Reno, Nev., as the principal place of business. The capital stock has been increased from $3,000,000 to $6,000,000. Henry A. Butters is president of the company and F. A. Ross superintendent.

SEATTLE & EASTERN.—Articles of incorporation have been filed by a company under this name in Washington, with a capital of $4,000,000, to operate railroads in any state and in any county in the state of Washington. W. H. Goldson, E. C. Gill and M. E. Heavey, of Seattle, and John McQuaid, of Issaquash, are incorporators.

SOUTHERN PACIFIC.—Surveys, it is said, are being made by this company for its proposed extension from Arnaudville north to Port Barrie, 12 miles, and from Lafayette northeast to Baton Rouge, 52 miles, all in Louisiana. The Baton Rouge extension crosses the Atchafalaya at a swampy point, and a large number of trestles will have to be built.

WORCESTER & PROVIDENCE (ELECTRIC).—This company, which has been incorporated in Rhode Island to build a street railroad through North Providence, Smithfield, North Smithfield and Burrillville, will file a map showing the location of its proposed road the first of next year. The officers are: F. C. Hinds, of Boston, President; F. W. Tillingnast, Providence, Vice-President; Charles H. Wilson, Boston, Secretary and Treasurer.

YOUNGSTOWN & OHIO RIVER.—Incorporation has been granted a company under this name in Ohio, with a capital of $10,000 to build a railroad connecting Youngstown with the Ohio river. The southern terminus will be at East Liverpool, and a branch is to be built to Salem. G. W. Hill, M. P. Goodman, C. H. Holland and others are incorporators. The office of the company will be at Leetonia, Ohio.

RAILROAD CORPORATION NEWS.

ALASKA CENTRAL.—This company has filed a mortgage to the Western Trust & Savings Bank, of Chicago, trustee, securing an issue of $30,000,000 5 per cent. bonds, part of the issue to be used for refunding.

ATCHISON, TOPEKA & SANTA FE.—This company has bought for a sum said to be $17,312,400 the Southern California, which owns 478 miles of road. The Atchison already owned all the common stock and nearly all of the preferred.

AURORA, ELGIN & CHICAGO (Electric).—It is reported that this company will be consolidated with the Elgin, Aurora & Southern Traction, which is controlled by the same interests. The A., E. & C. operates 57 miles of road between Chicago, Elgin and Aurora, and has $3,000,000 common stock, $1,500,000 6 per cent. cumulative preferred stock, and $3,000,000 first mortgage 5 per cent. bonds of 1941 outstanding. The E., A. & S. T. operates 72 miles of road between Carpentersville, Ill., Elgin, Aurora, Bristol and other towns, and has $2,000,000 stock and $2,000,000 bonds outstanding. It is said that the capital stock of the new company will consist of $3,000,000 common and $3,000,000 preferred stock, and also that the preferred stock of the A., E. & C. will receive a stock bonus of 20 per cent. and have its 18 per cent. of back dividends paid.

CHICAGO & NORTH-WESTERN.—This company has bought from the Chicago Railway Terminal Elevator Co. the Galena elevator, in Chicago, having a capacity of 700,000 bushels, for $398,000.

CHICAGO, MILWAUKEE & ST. PAUL OF MONTANA.—This company has been organized in Montana with $2,000,000 capital stock as a subsidiary of the Chicago, Milwaukee & St. Paul.

CINCINNATI, HAMILTON & DAYTON.—The receiver has announced that he will ask authority from the court to pay the interest on the following bonds, borrowing what money may be necessary: C., H. & D. second mortgage gold bonds of January 1, 1887; C., H. & D. refunding mortgage bonds of July 1, 1904; Dayton & Michigan Consolidated mortgage bonds of January 1, 1881; Indiana, Decatur & Western first mortgage bonds of November 1, 1895; Cincinnati, Ind. & W. refunding mortgage bonds of December 1, 1902; Pere Marquette collateral trust indenture bonds of January 1, 1903; Pere Marquette Consolidated mortgage bonds of January 2, 1901; Pere Marquette refunding mortgage bonds of January 2, 1905; Flint & Pere Marquette (Toledo Div.) first mortgage bonds of July 1, 1897; Grand Rapids, Kalamazoo & Southeastern Railroad first mortgage bonds of October 1, 1897.

The Board of Directors has taken action toward the annulment of the C., H. & D.'s lease of the Pere Marquette.

DULUTH, VIRGINIA & RAINY LAKE.—This company has changed its name to the Duluth, Rainy Lake & Winnipeg.

DETROIT, TOLEDO & IRONTON.—The report for the year ending June 30th, representing two months' operation by this company and the preceding ten months' operation of the road under the old name of Detroit Southern, shows gross earnings of $1,468,299, a decrease of $20,639; and net earnings of $153,695, a decrease of $46,154. The gross earnings for the four months ending October 31st were $1,319,153 and net earnings $428,733. The approximate gross earnings for November were $377,000. During these five months the company has not taken advantage of its trackage agreement with the C., H. & D., by which it secured an entrance into Toledo.

INTERBOROUGH RAPID TRANSIT.—This company, controlling all the elevated and subway lines of Manhattan, is, according to a plan under consideration, to be consolidated with the Metropolitan Street (surface) Railway and the Metropolitan Securities Company. The $35,000,000 capital stock outstanding of the Interborough Rapid Transit is to be exchanged, one share for two, for 4½ per cent. collateral stock of a new holding company. The $52,000,000 common stock outstanding of the Metropolitan Street Railway will be exchanged for 100 per cent. 5 per cent. cumulative preferred stock and 50 per cent. common stock of the new holding company. The $30,000,000 capital stock of the Metropolitan Securities Company, which has been paid up only to the extent of $50 per share, will be exchanged for 85 per cent. common stock of the new holding company after $25 per share additional has been paid in. A syndicate has been formed to underwrite the entire issue of common stock of the new company, but it has not yet been determined at what price this is to be underwritten. The syndicate, it is said, will include Kuhn, Loeb & Co., August Belmont & Co., J. P. Morgan & Co., and others. The capital stock of the new company will, according to the above terms, consist of $52,000,000 preferred and $83,000,000 common. It is said that $17,000,000 more additional common stock will be authorized. There will be $70,000,000 4½ per cent. collateral trust bonds.

KANSAS CITY SOUTHERN.—The directors of this company have voted to issue $5,100,000 5 per cent. six-year notes to be offered at 95 to common and preferred stockholders to the extent of 10 per cent. of their holdings; and a meeting of the stockholders has been called for February 1 to authorize the issue. As these notes should sell at par, the "rights" of stockholders are worth about 50 cents a share.

METROPOLITAN STREET RAILWAY.—See Interborough Rapid Transit.

NEW YORK, ONTARIO & WESTERN.—This company has purchased, through the Scranton Coal Co. the coal property of the Black Diamond Co. at Simpson, Pa. These coal deposits are estimated at about 1,000,000 tons.

NORTH COAST.—This company, which was incorporated last September to build an electric or steam road into the Yakima Valley, Wash., has filed amended articles of incorporation increasing its capital stock from $1,000,000 to $25,000,000. A director is quoted as saying that a $25,000,000 bond issue has been arranged for. He refuses to tell with what larger system this company is affiliated, but the Northern Pacific has been mentioned in this connection.

RUTLAND.—A dividend of 1½ per cent. on the $9,057,600 preferred stock has been declared. This is the first dividend on this stock declared since 1903, when 1 per cent. was paid. From 1892 to 1902 the dividend varied from 1 per cent, to 4 per cent. The surplus available for dividends on this stock in 1904 amounted to 1.6 per cent., and this year was about 1.7 per cent.

SEABOARD AIR LINE.—The Ruhstrat committee, which was formed to protect the interests of the minority stockholders soon after the promulgation of the Ryan-Blair plan for reorganization, has sold the shares of preferred and common stock pooled with it for about $68,000 to Middendorf, Williams & Co., of Baltimore, and John L. Williams & Sons, of Richmond. The prices paid were $55 per share of preferred and $35 per share of common, amounting in all to about $2,600,000.

SOUTHERN.—This company has leased the Transylvania, which owns 42 miles of road from Hendersonville, N. C., to Lake Toxaway.